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PC MAGAZINE

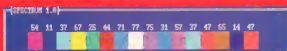
VOLUME 6 NUMBER 12
JUNE 23, 1987

Hands-on Reviews:

- Small Cassettes
- Big WORMs

*Plus: A Comprehensive Guide
to Backup Alternatives*

- Word Processor-to-Word Processor Conversion: Getting the Format Across
- Personal Picks: The Best Utilities of All Time



FREE EGA COLOR EXTENDER

Data Backup: The New Look

- Turn Your PC into a Fax Machine
- Turbo Utilities
- Zero-Slot LANs
- Compaq's 12-MHz Deskpro 286
- Build Your Own Pop-up Alarm



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Free spreadsheet included, complete with source code!

Yes, we've included MicroCalc, our sample spreadsheet, complete with source code, so that you can get started right away with a "real program." You can compile and run it "as is," or modify it.

A technical look at Turbo Basic

- ✓ Full recursion supported
- ✓ Standard IEEE floating-point format
- ✓ Floating-point support, with full 8087 (math co-processor) integration. Software emulation if no 8087 present
- ✓ Program size limited only by available memory (no 64K limitation)
- ✓ EGA and CGA support
- ✓ Access to local, static, and global variables
- ✓ Full integration of the compiler, editor, and executable program, with separate windows for editing, messages, tracing, and execution
- ✓ Compile, run-time, and I/O errors place you in the source code where error occurred
- ✓ New long integer (32-bit) data type
- ✓ Full 80-bit precision
- ✓ Pull-down menus
- ✓ Full window management

System requirements

IBM PC, XT, AT and true compatibles, PC DOS (MS DOS) 2.0 or later. One floppy drive, 256K.

The Critics' Choice

“Borland has succeeded in stretching the language without weighing us down with unnecessary details... Turbo Basic is the answer to my wish for a simple yet blindingly fast recreational utility language... The one language you can't forget how to use, Turbo Basic is a computer language for the missus, the masters, the masses, and me.

Steve Gibson, InfoWorld

Borland's Turbo Basic has advantages over the Microsoft product, including support of the high-speed 8087 math chip.

John C. Dvorak 33

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Reflex: the critics' choice

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Jerry Pournelle, BYTE

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Adam B. Green, InfoWorld

The next generation of software has officially arrived.

Peter Norton, PC Week '93

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- Line of Credit Tracking and Analysis
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- Purchase Order Entry and Analysis
- Purchase Order Tracking System
- Leasing Inventory Management
- Asset Inventory Tracking
- Cash Management Trial Balance
- Commercial Real Estate Tracking and Analysis

For Administration:

- Mail Lists
- Appointment Scheduling
- Applicant Tracking and Inquiry System
- Facilities Planning
- Project Scheduling

For Sales & Marketing:

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- Store Credit Inventory Analysis
- Sales Analysis
- Trend Analysis

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- Assembly Repair Turnaround Tracking
- Product Cost Analysis and Control

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Jerry Pournelle, BYTE '93

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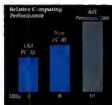
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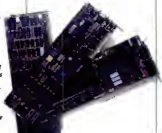
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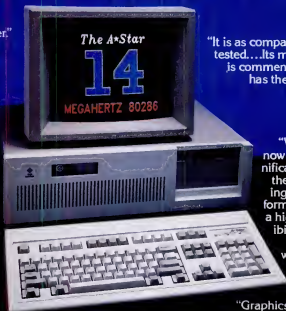
Computer Buyers Guide
—Compatibles Report

"If you're looking for a bargain-priced AT type computer - and there are many to consider these days - the A★Star is one that seems well worth the price."

Personal Computing
—Patrick Honan

"This computer is a whale of a buy....Inside the case it is neat and well designed. It just looks like quality!...I would find it hard to believe that you could outgrow the A★Star anytime in the near future...If I were buying a computer now it would be this offering from Wells."

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—Jake Epstein

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PC Magazine
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"What the world needs now is an AT which is significantly cheaper than all the others, while providing a higher level of performance than most, with a high degree of compatibility and good quality. And that's exactly what the A★Star II is."

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COVER STORY

Backup Choices from Tapes to Disks to WORMs

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Cover Photograph:

Roberto Brosan

WHAT'S INSIDE



Contributing editor Winn L. Rosch

The last time *PC Magazine* tackled a roundup of tape backup systems (in Volume 5 Number 3), we expected lightning-fast speed and painless operation. But many of the systems simply didn't work. This time around we again approached tape backup with the highest of hopes. We thought that the newest systems, which use tiny DC2000 cartridges that pack 40 megabytes and fit in your shirt pocket, would be powerful enough to rival all other backup systems.

After testing the units, however, our initial enthusiasm proved to be misplaced. While the DC2000 systems do indeed store more data in smaller spaces than ever before, they don't yet live up to their promise because they're too slow. And because many of the systems tested use floppy disk controllers, they run at floppy disk rates. On the plus side, all of the systems come with software that will automatically back up your system at the least disruptive time.

But no matter what the state of state-of-the-art backup systems, we still can't emphasize too strongly the importance of having one. Your chances of a hard disk crash are good: over the past 2 years, five of the AT systems used by *PC Magazine* editors have crashed 13 times. Therefore, in this issue, besides reviews of seven DC2000 systems ("DC2000 Systems: Pocket-Size Backup," page 111), we also describe the full spectrum of hardware backup options in "Backup Choices from Tapes to Disks to WORMs," page 101. And for those who need an archival backup system that can hold hundreds of megabytes of data, we review seven WORM systems ("WORMs for Mass Storage," page 135).

Sometimes it just takes a while for a technology to reach its full potential. That's certainly the case with the 12-MHz AT compatibles that we first reviewed in Volume 6 Number 7. But we've finally found a machine that's both fast and reliable in the new Compaq Deskpro 286 ("Compaq's Deskpro 286: The 12-MHz Champ," page 193).

In addition, we cover two other emerging product categories. The first is composed of boards and software that transform your PC into a fax machine ("PCs and Fax Get It Together," page 255). The other category, described in "Word Processor Translation Software: Preserving the Formatted Page," page 169, lets you trade files between different word processors—without losing the formatting codes.

All page formatting, in fact all screen attributes, look better when the screen resolution is EGA and the board's extended color palette can be fully tapped. This issue's PC Lab Notes unlocks the EGA rainbow with SPECTRUM, available free from our IRS. ☐



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Accounts Receivable
Inventory
Purchase Order
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- Accounting budgeting
- Financial ratios and more

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- Flexible aging
- On-line automatic posting
- Departmentalization by customer
- Customized text on statements
- Cash flow analysis
- Mailing labels
- Flexible invoice allocation
- Year business
- Automatic finance charges
- Notepad window
- Supports partial payments
- Sales analysis and sales budgeting and more

ACCOUNTS PAYABLE:

- Check printing from multiple bank accounts
- Automatic allocation of available cash
- Vendor directories and labels
- Flexible aging
- On-line posting to other modules
- Flexible invoice allocations
- Automatic reprinting of checks
- Notepad window
- Purchase forecasting
- Unlimited allocations per invoice
- 10 Invoices per check
- Flow-to invoice and more

BILLING:

- Invoicing on plan or pre-printed forms
- Special service billing routine
- Sales journal
- Invoice remarks
- On-line posting to other modules
- Credit memos
- Revenue & cost allocation
- Packing lists
- Point-of-sale invoicing and more

INVENTORY (PRODUCT OR SERVICE):

- Supports 3 main perpetual costing methods
- Physical inventory routine with count sheets
- Accepts any measure of units
- Special services file
- Automatic changing of costing methods
- Year history for all products and services with automatic forecasting
- Automatic pricing assignments
- Alert & activity reports
- On-line posting and more

PURCHASE ORDER:

- Items per P.O., per line and total discounts in % or %
- Full back-order control
- Purchase journal
- P.O. status report
- On-line processing and more

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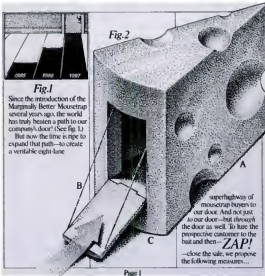
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PC Magazine, Jan 27, 1987

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CIRCLE 182 ON READER SERVICE CARD

LETTERS TO PC MAGAZINE



WORDPERFECT APPLAUSE

I would like to thank you for your excellent articles on *WordPerfect* ("WordPerfect Made Easy," *PC Magazine*, Volume 6 Number 7). I particularly enjoyed the reviews on training materials for *WordPerfect* ("Seventeen Ways to Learn WordPerfect"). Prior to reading this article, I was all set to purchase one of the training disks and books negatively reviewed. You have saved me a good deal of money and frustration.

Paul Ellenberg
Port Washington, New York



As a long-standing power user of the two-finger typing style, I really went crazy when I discovered *WordPerfect*. It beat the socks off my previous favorite—the correction key on the office typewriter. Therefore, I was very pleased to see that Bill Howard, et al., delineated the many wonderful things *WordPerfect* has going for it ("WordPerfect Made Easy"). I know that in our office, anyone who processes words does so with *WordPerfect*—it's the best. Thanks for the tips on how to make it work even better.

Mike Evans
Columbus, Ohio

I am amazed that your articles on *WordPerfect* made no mention of the *WordPerfect* Support Group ("WordPerfect Made Easy"). I have worked with *WordPerfect* for more than 3 years and have found the Support Group to be an invaluable source of help and up-to-date information about

the program. Daniel J. Rosenbaum concluded his article "Seventeen Ways to Learn *WordPerfect*" by saying it should be "easy to find a user group, colleague, or friend who can help you over the rough spots." The Support Group aptly fills the bill on all three counts.

Michael McCoy
Arlington, Virginia

NO FREE LUNCH

In a recent issue of your magazine, we discovered that hardware is a product that if played with long enough, breaks, and software is a product that if played with long enough, works (First Looks, page 38, *PC Magazine*, Volume 6 Number 4). Now, thanks to one of your advertisers, MicroCom Systems, we have discovered software that works us over!

In our particular case, we ordered a macro assembler and debugger for \$7 plus shipping and handling. We are now told that we will have to pay the software's creator, Mr. Isaacson, \$70, or face charges of piracy.

We feel that MicroCom's and Mr. Isaacson's marketing practices are, at the very least, unethical and possibly illegal. We feel that we contracted for disks at \$3.50 each with MicroCom and didn't invite Mr. Isaacson into the deal.

Ian G. Langsner
Binghamton, New York

There's no such thing as a free lunch. Companies such as MicroCom and PC-SIG merely distribute shareware and public-domain software—they don't sell it. As a distribution technique, shareware is gaining wide acceptance. Users and distributors alike, however, need to understand that using a shareware product con-

stitutes an agreement to pay the registration fee. It's not a charitable donation.—Ed.

ONE COPY DOES ALL

All of us at SoftKey Software Products are thrilled with your extremely favorable review of our *KeyChart* business graphics software ("Graphics Software on Display," *PC Magazine*, Volume 6 Number 5).

In this review, Bruce Brown mentioned that he wished he didn't have to buy two copies of *KeyChart* to get drivers for plotters, dot matrix printers, and laser printers. We think he's right. So as of the third quarter of 1987, the full version of *KeyChart*, selling for \$375, will support both plotters and printers and will contain new drivers for several film recorders. The \$149 version with only dot matrix and laser printer drivers will still be available for those who don't have a plotter and would like to save some money.

Gary Babcock
Product Manager
SoftKey Software Products
Santa Cruz, California



STATUS WAS STATED

Recently you did a complimentary review of Andrew Tobias' *Managing Your Money*, which stated that the program was the best and most useful of the personal money management programs (First Looks, page 34, *PC Magazine*, Volume 6 Number 3). Based upon the strength of your recommendation, I bought the product, only to

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 - **GAMES 6**—Pinball, Omelio, Dragons, Sopotih (ly on), and more. Color required.
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- **GAMES 9**—EGARisk, the game of world domination in very high resolution. EGA required.
- **GAMES 10**—Solitaire, Teed-Off golfing, and Solitaire in the Bermuda Triangle. Color required.
- **GAMES 12**—MyChess (8 levels). Backgammon, and Wheel of Fortune. Color not required.
- **GRAPHICS 1**—Record and play back screen images! Excellent for demo, etc. Color required.
- **INFO 2a,b**—(2 disks) Zip-Phone, national area/coder prefix to zip-code cross reference.
- **LANGUAGE 3a,b**—(2 disks) The ASB 2.18 macro assembler and debugger.
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find that it is copy protected. Yuck. I will never use this program. I feel like I've been had.

You would be doing your readers a great service if you required your writers to state the copy-protection status of every piece of software reviewed or recommended in *PC Magazine*. Perhaps then the number of copy-protected programs will diminish in the market.

Gary D. Griffis

Concord, Massachusetts

We always note the presence of copy protection. In this case, it was noted twice—once in the article and once in the accompanying Fact File.—Ed.

CANCEL THAT ORDER!

Charles Petzold's timely advice in *PC Tutor* just saved me the cost of a new 20-meg hard disk drive (*PC Magazine*, Volume 6 Number 6).

I had almost 1,100 files on my existing 20-meg hard disk drive, and while generating more files I received the dreaded "Out of Disk Space" message. It looked like I was going to have to have to order a second hard disk drive when I remembered reading Mr. Petzold's article. After some lengthy calculations, I determined that almost half of my hard disk was dead space. By following Mr. Petzold's article (very carefully), I reformatting my hard disk under DOS 3.2 and freed up 6.5 megabytes. Thanks very much for a great tip!

Larry Cronkite

Thousand Oaks, California

CHANGE FOR THE BETTER

In a recent *Inside Track*, John C. Dvorak decried several rumored aspects of the upcoming ADOS (*PC Magazine*, Volume 6 Number 7). But he seemed most worried about RAM-resident programs having to be implemented as device drivers: "It will be worse than the memory-resident conflicts ever were," says one observer. There'll be dozens of device drivers fighting for the same interrupts. **Bombs away.**

I believe the change is for the better. The scheme has been tried and proven in (gasp!) the Apple Macintosh. Desk accessories (the Mac's memory-resident programs) do not fight over system interrupts

but peacefully coexist with the rest of the system device drivers. Thus the operating system can pass on commands intended for them and give them their own slots of system time on a shared basis. And I've never heard a Mac user complain that one desk accessory wouldn't work with another or had to be loaded after the rest.

Larry Gilbert

Corvallis, Oregon

MANUSCRIPT MELANCHOLY

I agree with the conclusions the reviewers reached in the article on Lotus Development Corp.'s *Manuscript* ("Manuscript: A Technical Writer's Tool Kit," *PC Magazine*, Volume 6 Number 7).

Not only is the product difficult to use, but the document preview feature is excruciatingly slow on the XT. In addition, there seems to be a bug in the document preview portion of the program that often locks up my system. I have written to Lotus describing these problems in detail, but to date I have not heard anything from it. All I can say is I am very disappointed, and I wonder whether this product is really ready for the market.

Michael Downs

Portland, Oregon

As an employee for a company that specializes in writing technical documentation, I was very interested in your article on Lotus's *Manuscript* ("Manuscript: A Technical Writer's Tool Kit"). I found the article to be very clear in discussing both *Manuscript*'s enormous power and stifling problems. However, the authors completely missed what I feel is a major oversight in a product that is marketed toward the technical writer.

Manuscript supports only one printer port and will not support the use of a high-speed dot matrix for draft and a laser printer for finished output. As the reviewers noted, Lotus did not provide a DOS shell with which to set the DOS MODE command. This forces the user to completely leave the application, set the printer, and reenter the program to print a draft. Aside



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July 14, 1986

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HyperACCESS is an outstanding host, too. Even when you're not there, your PC can be accessed by callers who have passwords you've defined. You set whether each caller can read or type messages, transfer files, run programs*, or use your PC without restrictions.

HyperACCESS has the clearest, most complete script language, so you can create custom functions and menus, or automate any portion of a call. And we give you powerful scripts — transfer files between unattended PC's — pick up electronic mail at 2 am — act as a high-security dialback host, and more.

*Certain programs are incompatible with remote use.

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LETTERS

from the obvious inconvenience, *Manuscript* is very slow to load.

After waiting 15 minutes on Lotus's telephone nonsupport line, I was informed that the company was aware of the problem, and that no plans were in the works to address this bug at this time (but perhaps in a later release—at, I'm sure, Lotus's expensive upgrade fee).

Jeff Coleman
Teaneck, New Jersey

NOT SO FUNNY

In the March 31 Communiqués (First Looks, page 54, *PC Magazine*, Volume 6 Number 6), you reprinted a classified ad selling Atari equipment. I assume the ad was placed there to poke fun at the statement "2 happy disk drive." However, it may not be so funny. There is an upgrade for Atari disk drives called the Happy Enhancement. It's a hardware upgrade to allow the Atari drives to copy copy-protected disks. This may also explain why the advertiser is selling \$15,000 worth of software and the listed hardware for only \$1,000.

Gordon Mulcaster
Gibsons, British Columbia
Canada

A CASE OF DOS VERSUS DOS

This letter can't be real because it was composed on a Tandy 1000 SX, booted with MS-DOS 3.2. As you explained in your review of the 1000 SX ("Taking Back the Desk," *PC Magazine*, Volume 6 Number 6), this is impossible. Strange, that the machine comes with the wrong version of DOS.

Keith Spore
Wauwatosa, Wisconsin

Winn L. Rosch replies:

The article stated that the Tandy 1000 SX does not run IBM's PC-DOS 3.2, which is one measure of 100 percent IBM compatibility. While Tandy can be commended for recently upgrading the 1000 SX to run with MS-DOS 3.2, the machine still lacks support for PC-DOS 3.2. Contrary to popular belief, the two are not the same. This fact plus the additional features mentioned in the article pertain to the machine as reviewed and were confirmed by Tandy at the time of the review.

WELL WORTH THE EFFORT

I want to thank you for the programs you list in the Productivity section, especially for your efforts to allow all your readers to get them up and running. Since I don't have a modem or a macro assembler, I have to key in the BASIC listing. These listings chew up a lot of space in your publication, and I'm sure you must wonder if it's worth it. I assure you, it is to me.

Bob Wait
Cincinnati, Ohio

CORRECTIONS/AMPLIFICATIONS

We inadvertently left out two Editor's Choice products in the article "Special Delivery: Mailing-List Managers," *PC Magazine*, Volume 6 Number 6). Along with *Label Master* and *KeyMailer*, we also selected *FastPak Mail* and *Mail-Track-It*.

For a correction to the program XDIR ("Instant Access to Directories," *PC Magazine*, Volume 6 Number 7), see this issue's Programming/Utilities.

In the article "Behind the Screens: EGA and Multiscan Monitors" (*PC Magazine*, Volume 6 Number 6), we incorrectly stated the PC's Limited EGA Monitor's dot pitch to be .4mm. The correct dot pitch is .31mm.

In the article "Seventeen Ways to Learn WordPerfect" (*PC Magazine*, Volume 6 Number 7), several words are missing from the last line on page 226. The line should read: "... and the announcer's voice is pleasant and authoritative."

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Parts of Brief were written with its own Lisp-like macro language which has and uses 38-character variables names, conditional execution, loops, and even readability. Nothing like the hieroglyphs we've seen elsewhere. Bulletin board and public domain disks with macros. One of the best investments you can make. *PC Magazine* To top it off, there is a 30-day money-back trial period. **Ask \$195. Use Call.**

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keystrikes, and attachment of field-specific help messages and functions to user window called to display messages or valid data entries. And you decide which keys will clear a field, jump to the next or prior, cursor, etc. Clear manuals to boot. Specify Compiler. **Use PC Brand 70100 Windows for C \$245 \$216 70150 Windows for Data \$395 \$340**

MICROSOFT C 4.0 A Great C Battle Rages and You're Winning

It bundles a source debugger and a "make" and sports a "huge" memory model permitting single data objects larger than 64K, but what's really impressive about Microsoft C are the benchmarks. Run it away from the field of 17 Microsoft C 4.0 benchmarks.

The new "new" C debugger uses windows to show everything on one screen: source alongside disassembled object, variables stack and registers. Drop down windows obviate learning of commands. A source-level debugger that puts the rest to shame!" said Dobb's. Microsoft C has five memory models for code and data, plus no-library sup-

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port for another thirteen, and boasts alternate math packages for speed versus accuracy, with or without 8087/80387 chips.

Both linker and library manager are part of the package, as is the "make", which knows how to rebuild any else project by compiling only elements which have changed.

It is reportedly used by Lotus, Ashton-Tate and, frimly, Microsoft itself to develop Windows. Dobb's calls it "the best MS-DOS C development environment" value today [for] virtually any kind of program conceivable." 380K suggested.

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10 BIG REASONS IT'S TIME YOU CHANGED YOUR EDITOR TO BRIEF

1 FUNDAMENTAL TRUTH. If you are a programmer, you use your editor more than any other tool. If it isn't the best, the fastest, the most versatile, the most productive...well, then neither are you!

2 OUR ENTHUSIASM. While we do not publish BRIEF we wish we did. We sell so many BRIEFs that we've been advertising it non-stop since it was introduced two years ago. We're not alone in our enthusiasm. There is no end of accolades from other admirers.

BRIEF Encounters

"The word is getting around, that BRIEF is simply the best text editor you can buy." John Dvorak in *InfoWorld*

"In the last five years, only a handful of applications have altered the way we use microcomputers. The writers' impact is astounding. BRIEF is a winner that will most definitely change the way we develop applications software." *Cuts Based Advisor*

"Overall, BRIEF is an excellent and efficient editor with capabilities that are truly useful. If you're a serious programmer or developer of commercial applications, the BRIEF/dBRIEF package is one of the best investments you can make." *PC Magazine*, 7/86

"Every time I've mentioned text editors I've got a lot of mail urging me to try Brief. Now that I've tried it I see why it has windows boy, does it ever have windows! It will do just about anything you want it to. Look no further recommended." *Jerry Pourselle, Byte* 12/86

Best editor of 10 compared
Dr. Dobbs's Software Tools

3 WINDOWS ON THE WORLD. Why the excitement? First, BRIEF's architecture. Any number of files of virtually any length can be open. (Start BRIEF with "k" to prove it.) Open as many tiled windows as fit the screen—over/under and side-by-side—to work on any of your files. Open, close, and resize windows as you go. In each window, full screen or tiny, all editing techniques are at hand—high-speed cursoring, paging up and down, horizontal scrolling, optional word wrap. Load the same file in any number of windows to view different areas simultaneously. A change in one changes all. Cut and paste text blocks between windows and files, or into buffers for later recall. All files stay in memory, so you can always go back to snip some more.

WHOLLY MACROS.

4 Much of BRIEF was written in its own macro language. It is that powerful! The language and its compiler come with every copy, as do many standard macros, with source code for learning by example. It is a complete language with conditionals, loops, recursion, global and local variables, even data types. It can control files, windows, and the keyboard. It has structure, 32-character variable names, and—not at all like 1-2-3's "cupidom"—an entirely readable, like a hybrid of LISP and C. With it you can develop a library of routines to power BRIEF your way.

5 UNDO. NOT UN-DELETE. Don't confuse the two. BRIEF doesn't just keep snapshots of recent deletions; should you want to pick them up from the cutting room floor, it can reel the whole film back ward undoing any command that affected the cursor or the text. Watch it undo a global replacement, for example. Uncanny. It can global replace 300 times, all the way to the beginning of a session. "Works like a dream," said *The C/Journal*.

6 SHELL GAMES. Leave BRIEF, run your compiler, print out the error messages, load up BRIEF again? No way! Run your compiler from inside BRIEF*! It will point to each error line in your source program, still loaded in memory, for immediate editing. You don't have to leave BRIEF to use DOS either. BRIEF disappears from the screen to get out of your way, but say bye to DOS and BRIEF pops back to the screen, as do all the files you were working on.

7 KEY WHIZ. You can reassign BRIEF's command keys to whatever keys you're used to, even your old editor's, so you don't have to send your fingers back to school. Macro execution can be assigned to single keys. Or you can tell BRIEF to listen while you tap out a complex routine. It will save and playback faithfully, a shortcut macro without a single line of coding.

8 MULTI-LINGUAL. BRIEF's macro language is perfect for writing formatters for your language which indent, match up parentheses and brackets, and set up statement templates for fill-in. BRIEF comes with C language support already built in. Others have written macros to format Pascal, BASIC, LISP, Prolog, FORTRAN.

9 QUICKER PICKER-UPPER. Looking for something? BRIEF has full UNIX*-like expression search tools to locate and find for any file in memory. Literal strings with wildcards and "?" character masking, sure. But also indifference to case or intervening characters, [a-z] to match all vowels, or [-a-z] to match anything but vowels, [a-f-l] to match character ranges, beginning or end of line searches, even multiple choice pattern matching and replacement.

10 REASONS 11 THROUGH 20:
11. BRIEF comes with a color option. You can select your own color scheme anytime. 12. It supports EGA's 43-line

dBRIEF. The Power Environment for dBASE Programming

Many worthy utility programs supply needs that dBASE's programming language doesn't—UTIL-IT, dFUCW-TM and a host of others. Trouble is, you have to use them separately, then combine their output into your dBASE program files.

No longer. dBRIEF-TM, written in BRIEF's macro language, grabs hold of BRIEF and turns it into a complete dBASE III and III Plus programming domain. Using BRIEF's underlying shell capabilities and its own interfaces, dBRIEF can run external utility libraries, plus dBASE itself and link to the Clipper-TM, Foxbase-TM and Quicksilver compilers, all with dBRIEF still loaded and running the show. It can do what BRIEF already does plus:

- Convert a screen layout into dBASE code for interactive data entry.
- Display dBASE file structures in Windows a great convenience alongside your program files.
- Expand keystrokes into full dBASE statements.
- Index automatically for quick display.
- Create databases, index files, invoke Adhion-TM's dFCRMAT-TM and dCONVERT-TM, draw lists and boxes.

Simply marvelous programming environment for writing and editing dBASE programs. *PC Magazine*, 7/86. Source code included!

Requires BRIEF 1.32 or later and 384K, 512K to run dBASE within dBRIEF, 640K and harddisk recommended.

mode and can display up to 128 lines long. 13. Full 16-bit ASCII display, the whole character set can show on screen. 14. Full path support. 15. Command line start-up flags to modify BRIEF's behavior: change a path name, or run a macro for example "wp" which turns BRIEF into a word processor with wraparound and margin setting. 16. Automatic file save during idle moments. 17. Compatibility with most stay-resident programs (like Sidekick-TM), multitaskers (like Microsoft Windows-TM), and networks. 18. A bulletin board with public domain macros contributed by a mushrooming cult of microcrackers. 19. No copy protection. 20. Context sensitive help, and phone support from the publisher.

* Brief needs 16K or more RAM. 200K for complete feature. *Product must be returned in resalable condition.

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■ GUS VENDITTO

PC ADVISOR



Help in adding EGA and EMS when nearly all the slots are gone, in printing graphics screens, and in finding files on a crowded hard disk.

EGA WITH EMS

I've got only one more expansion set left in my PC. (A controller for the original two disk drives, an added hard disk card, a monochrome adapter, and a SixPakPlus board take up the rest.) I'd dearly love to get another megabyte or so of extended memory but would also like an EGA card for when I eventually upgrade my monitor. Which do you suggest? Or is there a board somewhere out there that combines both features?

Paul D. Counce
Ottawa, Ontario
Canada

Thanks to surface-mount technology, a couple of manufacturers have succeeded in packing EGA and EMS memory on the same board, and they throw in a couple of other features for good measure.

AST Research's SixPakPremium/EGA offers EGA (with mono and CGA modes) and up to 2 megabytes of memory that's compatible with LIMS EMS and with AST's enhanced EMS standard. The SixPakPremium/EGA also gives you a serial port, a parallel port, and a battery-backed clock (AST Research; Irvine, Calif.; (714) 863-0181; \$995 with 256K bytes, \$1,295 with 1 megabyte, \$1,795 with 2 megabytes).

IDEAssociates' All Aboard comes with EGA (mono and CGA modes included) and up to 2 megabytes of LIMS EMS. You get the same configuration of ports offered with the SixPakPremium/EGA, but instead of a clock you get an ST-506-standard hard disk controller that will work with a

wide variety of hard disk drives on the market (IDEAssociates; Billerica, Mass.; (617) 663-6878; \$695 with no memory, \$1,095 with 1 megabyte, \$1,595 with 2 megabytes).

Either would make an ideal upgrade solution for you since both will work with a monochrome monitor or an enhanced color display.

SCREEN GRAPHICS DUMPS

I need to locate a memory-resident program that will intercept a Shift-PrtSc command to perform a screen graphics dump to my Toshiba P1340 printer. Can you help?

Dan Jordan
Golden, Colorado

Pizzazz does a fantastic job of translating screen graphics—including multicolored displays—into black-and-white printouts with a nice range of gray-scaled tones. It's

■ **Pizzazz does a fantastic job of translating screen graphics—including multicolored displays—into black-and-white printouts.**

a simple program that does a polished, sophisticated job (Application Techniques; Pepperell, Mass.; (617) 433-5201; \$49.95).

Another program that does an equally good job at printing screen images, but gives you a second level of features for an extra 50 bucks, is Inset (American Programmers Guild; Danbury, Conn.; (203) 794-0396; \$99). It can call those images into a screen editor, where you can add or remove text, change lines, or what have you. You can use these altered displays in a separate application or simply print them.

Both programs work with your printer and most popular models; in addition to the standard Epson and IBM drivers, both programs have drivers for these troublesome printers and a few more. For the benefit of others with the same need, here's a list of some of the printers supported by both Inset and Pizzazz: the Toshiba P351 and P1351; the Okimate 20; the Okidata Microline 83, 84, 92, and 93; the Okidata Microline 192 and 193; the Anadex Scribe Series; and the HP ThinkJet, Laserjet, and Laserjet Plus.

SEARCHING FOR FILES

I'm a secretary in a growing company. Ever since my boss bought an IBM PC and a word processing program last year, my work load has seemed to get heavier. You see, everyone creates more memos and makes more revisions than before.

Now my hard disk contains hundreds of documents that I have to refer to all the time. Sometimes, it can take a few hours to

■ PC ADVISOR

recall just a single document!

Can you recommend a program that can help me locate a file from among the directories and/or search for a phrase in more than one file? To top the list, the search should be smart enough so that I don't have to enter the exact phrase.

Your timely advice would mean my next big raise!

Madeline Wane
Burlington, Massachusetts

This advice ought to push you up a few tax brackets.

First, get a better overview of your files with a DOS shell. I can recommend two utilities that will let you search on entire disk for a file by name (using wildcards if you don't remember the entire filename) and that offer a variety of file-management tools that will give you a better handle on your menagerie: QDos (Gazelle Systems; Provo, Utah; (800) 233-0383;

■ ZylIndex or Dragnet can do the complex searches you need to find the odd word or phrase in a disk full of files.

\$44.95) and DOS2ools (E-X-E Software Systems; Huntington Beach, Calif.; (714) 662-2535; \$99).

Next, get either ZylIndex (Zylab Corp.; Chicago, Ill.; (312) 642-2201; standard version, \$145, professional version, \$295) or Dragnet (Access Softek; Berkeley, Calif.; (800) 222-4020; \$145). They can do the complex searches into every file that

you need to find the odd word or phrase in a disk full of files.

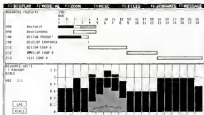
In choosing between the two, consider that ZylIndex needs to create an index of all your files the first time you run it, but it will then search for key phrases quickly and effortlessly; if you have (or expect to have) more than 500 files on a disk, you'll need the more expensive professional version. Dragnet does not need to index files but is slower during searches; it also needs graphics of some sort (Hercules, CGA, or EGA) and at least 512K bytes of RAM. ZylIndex needs but 256K and has no special requirements.

ASK THE ADVISOR

Send questions about hardware or software choices you are facing to the PC Advisor, PC Magazine, One Park Avenue, New York, NY 10016. Please specify the equipment you are using when explaining your problem.

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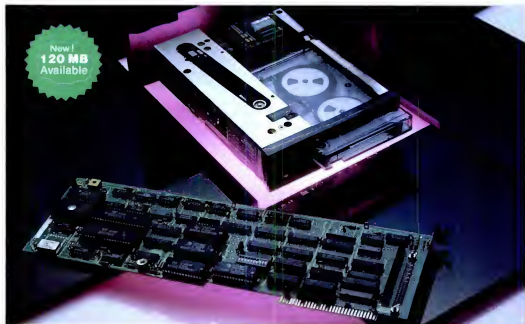
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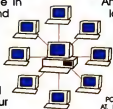
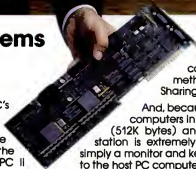


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FIRST LOOKS

Zenith and NEC Set Higher Standards for Laptop PCs

PC HANDS ON

BY PAUL SOMERSON

Zenith Data Systems and NEC Home Electronics have just redefined the high end of the laptop market with a hot new pair of supercharged backlit portables.

These two Chicago-area-based manufacturers aren't exactly strangers to the market. NEC's earlier 9.54-MHz, V30-based MultiSpeed was one of the first laptops to put real muscle into an affordable chassis. And Zenith's sleek Z-181, with its shocking blue backlit screen, had blown the murky LCD competition out of the water.

Zenith's Z-181 Portable PC (right) boasts the same stand-out screen as the Z-181, but a faster (8 MHz) microprocessor and a 10-megabyte hard disk make this machine a real trend-setter among the DOS-to-travel laptop computers. NEC's new MultiSpeed EL adds a backlit, twisted-crystal display that is the equal of Zenith's for legibility.



But both of these machines needed help. The MultiSpeed's nonbacklit supertwist screen was as unreadable as all the other gloomy, leaden LCDs crowding dealers' shelves, and the mechanism that swung it open and closed was downright awful. The Z-181 plodded along at a stately 4.77 MHz. It cried out for a handle, its keyboard layout was haphazard, and it had recharging headaches.

Help has arrived. NEC, which had wisely designed its screen to be removable, is now offering the MultiSpeed EL with a slightly muted version of Zenith's throbbing blue backlit display, with a friction fitting

(continues on page 34)

InColor Card: Better-Than-EGA Resolution with Hercules Drivers

PC HANDS ON

BY WINN L. ROSCH

Hercules Computer Technology's new InColor Card brings compatibility with Hercules software drivers to EGA-standard color monitors. Along with new hues, Hercules has added better-than-EGA resolution and downloadable character fonts, without sacrificing complete compatibility with programs following the Hercules graphics standard.

Compared with that of an EGA board, the resolution improvement offered by the InColor board is perhaps its most doubtful virtue. The Hercules board yields a resolution of 720 by 348 pixels, little better than the 640 by 350 achieved with an EGA.

Moreover, the color selection allowed by the two boards is identical—a choice of 16 from a palette of 64.

The greater strengths of the new Hercules product are its compatibility with mono-

chrome graphics software and with the RAMfont abilities of Hercules's monochrome Graphics Card Plus.

RAMfonts permit you to download new character fonts (including odd sizes and proportionally spaced characters) from disk files and substitute your choice for the plebeian PC typeface. Once a font is loaded, it becomes the default for all text-mode programs except for the few that are designed to take advantage of the RAMfont capa-

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that makes positioning it a joy. Zenith hot-rodded the Z-183 Portable PC's performance up to a respectable 8 MHz, fixed most of the keyboard and power woes, and, in a bold stroke, dropped in a battery-powered, shock-mounted hard disk.

The machines aren't perfect. The MultiSpeed EL screen, though vastly improved, is still squashed and oblong compared with Zenith's large, true-aspect display. It lacks the startling, almost 3-D brilliance of the Zenith screen, but is way ahead of the somber nonbacklit LCDs on other laptops. (Its engineers claim they toned down the NEC backlit panel so that it will significantly outlast the jazzier luminous panel used by Zenith.) And the overall MultiSpeed EL chassis design is swoopy and visually jarring.

Zenith, too, has room for improvement; while it did a masterful job conforming its Z-183 keyboard to the IBM Selectric standard (and eliminating trouble spots like the single, shared Ins/Del key on the Z-181), it actually made the 183's button-like function keys harder to use by jamming them tightly together in the topmost row. And some scrawnier users might balk at the 16-pound heft, but the thing is built like a tank, as all road machines should

Laptop Prices Thrown into Confusion

These new laptops from Zenith and NEC were announced at a time when a U.S. tariff on 16-bit laptop computers imported from Japan resulted in confusion over laptop prices.

The sanction threatens to double the cost of NEC's MultiSpeed but will spare Zenith's Z-183, even though it is made in Japan, because the Z-183 uses an 8-bit 80C88 chip. The 16-bit V30 in the MultiSpeed will trigger the 100 percent tariff on units brought into this coun-

try. NEC had a large supply before the tariff was imposed, so prices should not rise until the company reorders from Japan. Toshiba, Wang, and Sharp share NEC's dilemma.

If the tariff continues, it's expected that all of these manufacturers will attempt to assemble the machines in the United States. The alternative is to withdraw the machines from the market rather than attempt to sell a machine at twice its current price.

—Gus Venditto

be—and after all, what do you expect from Chicago, the City of the Big Shoulders?

The MultiSpeed EL and the Z-183 retain most of their predecessors' best features. The NEC laptop, with its full-size function keys at the left edge of the keyboard and its dedicated cursor/numeric keypad, is still the power-typists' favorite. Zenith's new keyboard wins points for its much-improved layout. Both keyboards provide superior travel and feel closer to the unbeatable IBM action than virtually all the competition. And now both sport shift-state LEDs.

Zenith's earlier twin-disk model was hard to carry. The

new Z-183 now boasts a brand-new handle that's better than the MultiSpeed's: it's centered and rock-solid, and retracts neatly into the case. The NEC handle wobbles annoyingly, protrudes slightly from the top even when not in use, and is off-balance. However, most users will probably opt for carrying cases. Zenith's is a tough, light, black nylon American Tourister shoulder bag. NEC is pushing a massive, indestructible leather bellows-type briefcase.

Both come standard with 640K bytes of RAM; parallel, serial, and external RGB ports; a real-time clock; and space for an optional modem (NEC leaves its ports uncovered,

which means they get filthy fast). The MultiSpeed EL throws in an external floppy disk port and lops off some of its memory to provide a 128K-byte battery-backed-up CMOS RAMdisk. Zenith's new model lets you plug in an optional numeric keypad, or a whole PC keyboard, and you can have the factory install a megabyte of EMS memory and an 8087 math chip. Both systems fail to beep when you close the lid without first turning the system off—something they should do.

While Zenith's system is based on an 8088 CPU, NEC's homegrown V-series version of the 8086 cranks out a bit more power and 20 percent more speed. With the Z-183 you get one top-mounted disk and a relatively frisky hard disk; the MultiSpeed offers twin side-mounted disks only. The NEC provides 512K bytes of forgettable ROM software and is delivered with empty sockets for your own ROM applications.

Zenith also upgraded the chip in its smaller, dual-floppy Z-181 to run at the same 8 MHz as the Z-183 (but didn't upgrade the 181's keyboard). NEC is offering its MultiSpeed with a choice of screens—the unreadable one for \$1,995, or the sizzling new backlit display for \$2,499. Current MultiSpeed owners may upgrade for a modest \$499.



Benchmark Tests: Zenith Z-183 vs. Compaq Portable III

The Zenith Z-183 is among the faster laptops, but when pitted against Compaq's 286-based Portable III, the limitations imposed by its compact size hold it back. The Z-183's hard disk access time, however, is comparable to many desktop XT's.

Performance Times

(Times given in seconds except where noted)

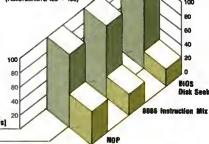
| | NOP | 8086 Instruction Mix | BIOS Disk Seek (milliseconds) |
|---------------------|------|----------------------|-------------------------------|
| Zenith Z-183 | 7.57 | 22.14 | 110.09 |
| Compaq Portable III | 3.50 | 6.60 | 27.36 |

The NOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instruction in a big 128K loop.

The 8086 instruction mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction codes. These instructions are a subset of the total processor instruction set.

The BIOS Disk Seek benchmark test measures the time it takes to do a random seek using the disk's FDISK BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

Relative Times
(Ratio: Zenith Z-183 = 100)



Aside from the new screen, the MultiSpeed EL is the same speedy computer as the original MultiSpeed. Because NEC wisely made the MultiSpeed display detachable, an upgrade is simple.

The new Zenith Z-183, on the other hand, requires a larger chassis than the Z-181 in order to squeeze in the hard disk.

Top-notch Laptops

This duo of readable laptops with power to burn are the machines of choice. By comparison, Toshiba's T1100 Plus does pack a wallop in a tiny box, but its keyboard is too cramped and its screen utterly drab and dreary. The Toshiba T3100, with its fearsome Darth Vader looks and painfully slow hard disk, has to be plugged into a wall. (It is now being pitched in a goofy ad by Brooke Shields, who is seen using it to plot a three-dimensional bar chart while she reads *Madame Bovary*. Doesn't everyone?) GRID's hardware is improving, but has a huge gulf to cross. All of the other machines either have shadowy, dim, dull, unreadable LCD screens or clattery, mushy keyboards, or both.

What You Pay For

The biggest problem with the Z-183 is its cost; at \$3,499, it's overpriced. But for that sum of money you get the equivalent of a trim, fast XT that you can tote handily wherever you go, and run without worrying about power outlets. It's also larger and heavier than some users will accept, but that's the price you have to pay for a sturdy shell, shockproof hard disk, and eye-popping screen that's nearly as large as a normal monitor. The alphanumeric keyboard is excellent, the styling top-drawer, and the screen the absolute best there is. It's a superb machine throughout.

But if you want raw, flat-out power, the best keyboard on a laptop, and an eminently readable backlit display—and don't mind the odd styling, silly handle and firmware, or flattened screen—snap up a MultiSpeed. The price is right (\$2,499) and so is just about everything else the machine offers.

PC FACT FILE

Zenith Z-183 Portable PC

Zenith Data Systems
1000 Milwaukee Ave.
Glenview, IL 60025
(800) 842-9000

List Price: \$3,499. 300/1,200-bps Hayes-compatible modem, \$399; carrying case, \$59; external 5¼-inch floppy disk drive, \$399; extra C-cell battery pack, \$119; external battery pack recharger, \$29; automobile cigarette lighter power adapter, \$19; PC XFER null modem and software, \$99.

In Short: A bit oversized, overweight, and overpriced, but you just can't buy a sturdier, better-looking, more capable laptop. Its function keys are pitiful, but overall, the battery-powered hard disk, newly redesigned Selectric-type keyboard, and awesome backlit screen make this the top-dollar portable of choice.

CIRCLE 442 ON READER SERVICE CARD

NEC MultiSpeed EL

NEC Home Electronics
(U.S.A.) Inc.
1255 Michael Dr.
Wood Dale, IL 60191
(312) 860-9500

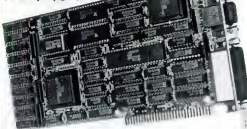
List Price: \$2,499. 300/1,200-bps Hayes-compatible modem, \$399; external transfer cable kit (for PCs and XT's), \$99; serial transfer kit, \$159; RS-232 cable for external modem, \$49; RS-232 null modem cable, \$49; printer cable, \$49; automobile power cable, \$20; carrying case, \$99; extra nickel cadmium battery, \$99.

In Short: A star performer with a super keyboard—at a truly competitive price. The styling could be slicker and the display larger, but it offers some nice extras (like a CMOS RAMdisk). The new backlit screen, although not as large or bright as the Zenith's, turns this muscular machine into an attractively priced, runaway winner.

CIRCLE 443 ON READER SERVICE CARD

InColor Card

(continued from page 33)



256K of video RAM and several VLSI chips contribute to the InColor Card's just display writing and choice of character fonts.

bilities of the board. Hercules supplies more than a dozen monospaced fonts to experiment with and a utility with which to build your own.

The colors the InColor Card uses for text and existing Hercules-compatible graphics programs (two colors only) can be selected from a menu-driven program, Setcolor, supplied with the board.

Only a few applications can exploit the full spectrum of the board. Hercules supplies InColor drivers for I-2-3, *Symphony*, *Javelin*, *Windows*, and a few other programs. The documentation gives enough technical details that idle hackers can write their own drivers.

Although the InColor Card requires an EGA display (or multisync monitor), it is not compatible with EGA software. Nor does it work with monochrome displays. However, it does include a built-in IBM-compatible parallel printer port.

Clever Circuitry

To achieve its perfect Hercules monochrome compatibility, the InColor Card uses a clever circuit design that's based on several proprietary VLSI chips and 256K of RAM in eight 4 × 64-kilobit chips.

The memory is arranged in four planes, one of which is identical to that used by the Hercules Graphics Card. The other three planes hold color information. All of the InColor Card circuitry fits on a two-thirds length circuit that's XT-height and makes use of the PC/XT eight-bit databus.

Because it works with conventional software as if it were a monochrome display adapter, the InColor Card is fast, even in color. Moreover, it never flickers and generates snow.

Choose the InColor Card for sharp, colorful text and graphics if you're committed to the Hercules standard. It will let you move software smoothly between color and monochrome systems without reinstalling your software, unlike VGA (Video Graphics Array), which will require new drivers.

Whether the InColor Card becomes a new standard depends on software developers, most of whom are preoccupied with the new VGA standard, which promises even better resolution, both monochrome and color compatibility, and support by IBM.

PC FACT FILE

InColor Card

Hercules Computer Technology
2550 Ninth St.
Berkeley, CA 94710
(415) 540-0600

List Price: \$499

Requires: EGA-compatible or multisync monitor

In Short: A display adapter that adds color to high-resolution, 720- by 348-pixel Hercules-compatible text and graphics on EGA or multisync monitors

CIRCLE 444 ON READER SERVICE CARD

\$249 WordPerfect Executive Condenses Several Applications for Travelers

PC HANDS ON

BY MITT JONES

WordPerfect Corp. is wooing professionals on the go with *WordPerfect Executive*, a \$249 integrated package geared toward laptop users. *Executive* packs a subset of *WordPerfect*, *WordPerfect Library*, and *MathPlan* (WordPerfect Corp.'s powerful but little-known spreadsheet) on one 3½-inch disk. The result is a highly integrated, value-packed package that includes a word processor, spreadsheet, calendar, calculator, and phone list; it is shipped with both the 3½-inch version and the 5¼-inch version (on two disks).

If you already use *WordPerfect*, you'll feel at home using *Executive*. You access the program modules from the Shell, a slightly modified version of the central menu offered in *WordPerfect Library*. *Library* also lends its thoughtfully designed appointment calendar and calculator, its notebook, and its clipboard, which lets you easily move data from one module to another. Missing are *Library's* File Manager and Macro/Program Editor.

The word processor is essen-



Executive's shell menu marks the modules currently in RAM with an asterisk. The Memory Map shows how much RAM each program is occupying.

tially *Junior WordPerfect*—a scaled-down but upwardly compatible version of *WordPerfect*. It retains *WordPerfect's* basic features and a few of its power features, including header/footer capability and a 50,000-word version of the spelling checker. Gone are the preview function, footnotes and endnotes, columns, and the powerful printer control screen. Document conversion consists only of ASCII import/export.

The spreadsheet keeps *MathPlan's* 256 by 8,192 grid and its powerful calculation abilities, but it dispenses with all but one of *MathPlan's* six

graph types, as well as a few other niceties. Document conversion supports 1-2-3 files.

Overall, *Executive* is tightly integrated and easy to learn. WordPerfect Corp. somehow managed to fit all of *Executive's* function-key commands on one keyboard template. And similar commands in different modules share the same function-key combination, so commands are easy to remember from one module to the next. With a few minor exceptions, the function-key combination for a command in any module also corresponds to the combination in the standalone product.

The clipboard is the key to *Executive's* integration. You save any portion of data from any module to the clipboard by pressing Ctrl-F1 and choosing Save or Append. When you're ready to retrieve the data, you move to the correct module and again press the Ctrl-F1 combination. You choose Retrieve to copy the data into the application. Any word processor or spreadsheet file created within *Executive* can be used by *WordPerfect* or *MathPlan*, respectively, with no changes.

WordPerfect and *MathPlan* files can also be used by *Executive* with no changes. *Executive* will simply ignore, but leave intact, control codes it does not understand. I encountered no

problems moving tricky *WordPerfect* documents in and out of *Executive's* word processor; however, you won't be able to view your *WordPerfect* footnotes, for example, when editing the file with *Executive*, unless you use the reveal-codes function.

You also won't be able to run your *WordPerfect* and *MathPlan* macros within *Executive*. Instead, you can build shell macros for any *Executive* application. Shell macros are compatible with *WordPerfect Library* macros.

Executive's on-line help and documentation are above average. However, I had to pick through the documentation to discover the differences between *WordPerfect Executive* and the *WordPerfect Corp.* products I already use. A section outlining the differences would help any *WordPerfect* user who wants to get the most out of *Executive*.

All in all, *WordPerfect Executive* is well worth its price, especially to *WordPerfect* users who like to tote a laptop on the road. Depending on your needs, *Executive* may warrant consideration as your primary office system, though printer support is somewhat limited.

PC FACT FILE

WordPerfect Executive

WordPerfect Corp.
266 West Center
Orem, UT 84057
(801) 227-4020
List Price: \$249
Requires: 256K RAM,
DOS 2.0.

In Short: A low-cost grab bag of integrated features for those who need power on the road but want to travel light. Not copy protected.

CIRCLE 445 ON READER SERVICE CARD

Software for the Road

WordPerfect Corp. is the first major publisher to introduce a condensed version of software aimed toward laptop users. Whether or not this will be the beginning of a trend remains to be seen, but *WordPerfect's* lead may prove to be hard to beat.

Bought and used as individual packages, *WordPerfect*, *WordPerfect Library*, and *MathPlan* have a combined list price of \$1,019 and occupy 14 360-Kbyte floppy disks (10 after printer installation). *WordPerfect* alone retails at \$495 and occupies six floppy disks.

While the \$249 *Executive* sacrifices some of the power of the separate packages, it offers more than enough features to accommodate the needs of many on-the-road executives—all on one 3½-inch disk. And upward file compatibility lets you exchange files between *Executive* and *WordPerfect Corp.'s* standalone products with no problems.

WordPerfect Corp. has even managed to reduce the documentation to pocketbook size for easy packing.

—Mitt Jones

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| 3 serial, 3 parallel in | |
| – 1 serial out | \$249. |
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WordPerfect
CORPORATION

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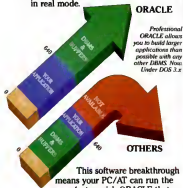
All PC DBMSs have three serious limitations. First, very little room is left for your application after deducting the size of DOS and the DBMS from the available 640K. Second, they don't provide easy, transparent access to minicomputer and mainframe data. Finally, multi-user applications are impractical because of long delays caused by LAN data lock-out. Three serious limitations. Not any more.

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When other PC DBMSes claim "connectivity," they mean terminal emulation or file transfer, downloading and uploading static data snapshots.

With Networkstation ORACLE, an ordinary PC (XT as well as 286 or 386) becomes a true distributed application processor. You can dynamically access and update a remote database—either ORACLE or IBM's DB2—as if it were stored on your PC.

What's more, ORACLE's SQL*Star distributed database architecture—the first ever on PCs—lets you query or update local PC and remote databases simultaneously. Even join them into a single view. Without knowing where your data is located. So you can distribute your data to where it's used the most. Control, secure, and back it up however you want. And still network it all together whenever you need to.

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|-------------|-------------|-------------|
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| Medium | 3270 Coax | 50 Kbps |
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Distributed Database

Familiar 1-2-3-like Spreadsheet Interface

ORACLE H

DATABASE SERVERS FOR LANs. NOW.

Using an Ethernet LAN, you can connect Networkstation ORACLE PCs to a variety of powerful ORACLE database servers. Such as the MicroVAX 2000. Soon, you'll be able to connect them to PC ATs, Personal System/2s or the new Compaq 386 running LANserver ORACLE.†

Other PC DBMSes execute entirely in your workstation PC, using a network file server to perform file and byte-range locking. Their results? Excessive network traffic,



frequent waits for busy records, and corrupted databases from aborted transaction streams.

ORACLE's database-server architecture ensures minimum network traffic, maximum concurrency, and data integrity for the most demanding multi-user applications. Just like a mainframe. And at one-fifth the cost of the least expensive proprietary database machine.

TRIBUTED DBMS FOR 286/386 PCs

THE 640K BARRIER ON THE PC

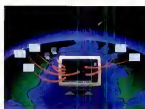
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|--------|----------------|-----------------|
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| NOW | NO | NO |
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☐ LANServer ORACLE for the MicroVAX 2000. \$4750.

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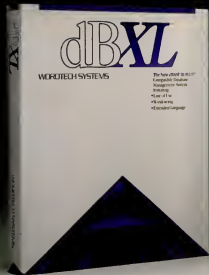
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With dBase, both files and syntax are compatible with dBase III Plus. You can interchange databases, indexes, and other files between the two products. And if you've used dBase, you'll only need to learn the commands we've added (yes added) to make the dBase III language more powerful. They run the same. But with dBase you'll have more to run with. And you don't need to worry that we're stepping on anybody's toes, because our unique agreement with Ashton-Tate makes dBase a safe alternative.

If you're new to dBase, dBase INTRO lets you run the program with menu choices. A "tutor" line simply shows you which dBase III Plus command you're creating with the menu. If you goof, error messages are simple and easy-to-understand, and two levels of *Help* are just a function key away. Even our documentation is easier; it's better written, better organized, and more concise.

For you power users, we've included special features like access to DOS services, up to 99 windows without any other software, and automatic memory variable management. Whether you're programming for yourself or others, dBase is the ultimate development tool.

Unlike dBase III Plus, dBase runs on PC-DOS or MS-DOS, so you can run it on the HP-150,[™] the TI Professional,[™] and the Apricot,[™] to name a few.

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CIRCLE 161 ON READER SERVICE CARD

Noble 386: A 45-Pound, 32-Bit Portable PC at a Bargain Price

PC HANDS ON

With the speed of a Deskpro 386, the Noble's strong suit is clearly performance.

The \$2,999 Noble 386 includes one 360K disk drive and a 20-megabyte hard disk. Our evaluation unit also included a high-capacity, 1.2-megabyte disk drive.



PC FACT FILE

Noble 386 Portable
PC Discount
2758 Bingle Rd.
Houston, TX 77055
(800) 843-7042
List Price: \$2,999

In Short: A well-made portable built with familiar off-the-shelf components, it offers fast processing, a slow hard disk, and arm-stretching heft.

CIRCLE 424 ON READER SERVICE CARD

BY HOWARD MARKS

The Noble 386 Portable from PC Discount is arguably the world's fastest portable computer. Unfortunately, only professional wrestlers strong enough to carry its 45-pound weight to the airport gate are likely to avail themselves of this performance.

Running an Intel 386 processor at 16 MHz, the Noble 386 features a performance that's about twice that of an 8-MHz AT and comparable to that of the Compaq Deskpro 386. PC Discount has lived up to its name, making the Noble 386, at only \$2,999, among the least expensive 386 machines currently on the market.

The Noble 386 is a masterpiece of the "Shopping Cart School of Computer Design." It uses Intel's iSBX 386 motherboard, a Hercules clone video controller, a Phoenix BIOS, a case that looks amazingly like the original Compaq portable, and a variety of other off-the-shelf components.

Host of Features

PC Discount has produced a quality, inexpensive, and almost-portable 386 machine. The Noble 386 includes an amber monitor with a Hercules clone controller, one 360K-byte floppy disk drive, a socket for a 387 coprocessor, a 20-mega-

byte hard disk, six expansion slots (one 32-bit and three 16-bit), serial and parallel ports, and 512K bytes of memory expandable to 4 gigabytes (4,000 megabytes).

Fast Processing

Performance is clearly the Noble's strong point. On all of the PC Labs processor and memory benchmark tests the Noble 386 displayed speeds twice that of an 8-MHz AT and comparable to other 386 machines.

I was disappointed, however, to see that PC Discount is us-

ing a slow, 65-millisecond access, 20-megabyte hard disk. I find it difficult to believe that anyone using a 386 machine would be satisfied with either the size or performance of this drive. I was also disappointed that the Noble did not have any card hold-downs or stabilizers other than the standard single screw.

The Noble 386 is a well-built, low-cost, 386-based luggable. Right now it's far and away the fastest portable computer on the market and is strongly recommended for those users needing both speed and luggability. But with its slow hard disk, it won't cut it as a sometimes transported desk-top PC.



Benchmark Tests: PC Discount's Noble 386 Portable vs. Compaq Deskpro 386

At a discount price, PC Discount's Noble 386 Portable performs close to Compaq's standard-setting Deskpro 386. The Noble's weakness is clearly its slow hard disk.

Performance Times

(Times given in seconds except where noted)

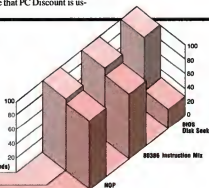
| | NOP | 80386 Instruction Mix | BIOS Disk Seek (milliseconds) |
|----------------------------------|------|-----------------------|-------------------------------|
| PC Discount's Noble 386 Portable | 2.09 | 4.62 | 95.50 |
| Compaq Deskpro 386 | 2.01 | 4.20 | 27.00 |

The NOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a loop. (2088 loops)

The 80386 Instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the 80486 processor instructions list.

The BIOS Disk Seek benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

Relative Times
(Ratio: Noble 386 Portable = 100)



■ NEW ON THE MARKET ■ JONATHAN MATZKIN

C. Itoh Laser Printer Adds Low-End Choice For Business Users

Falling prices have made laser printers into cost-effective tools for general business use. The latest low-priced entry is from C. Itoh Digital Products. The \$1,795 Jet-Setter uses a Konica laser engine to produce 5 pages per minute at 300 dot-per-inch resolution.

The printer comes with 512K bytes of RAM, and an optional 1.5-megabyte memory upgrade is available to allow full-page 300-dpi graphics.

HP Laserjet Plus emulation is standard, and the Jet-Setter uses font cartridges compatible with Hewlett-Packard's font combinations. Two front-mounted cartridge slots accept two optional font cartridges, two optional emulation cartridges, or one of each.

A paper cassette holds 100 sheets of letterhead, plain, or A4 size paper, and there is an optional legal-size cassette. Output can be either face-up or face-down for collating. Centronics parallel, RS-232C, and RS-422 interfaces are standard.



The Jet-Setter from C. Itoh (\$1,795) is part of a trend toward lower-priced, general-purpose laser printers. The printer is aimed at business users who were previously priced out of the laser market.

List Price: Jet-Setter, \$1,795. C. Itoh Digital Products Inc., 19750 S. Vermont Ave., #220, Torrance, CA 90502; (213) 327-2110.

CIRCLE 433 ON READER SERVICE CARD

EGA Card for \$199: High-Resolution Color Graphics at Low Price

Once considered a state-of-the-art luxury, EGA graphics have become a commonplace business tool. And now that even higher resolution standards have appeared, prices for EGA cards have started to come down.

Boca Research has introduced the EGA by Boca, a full-featured 640 by 350 EGA card that is priced at \$199. It displays 16 colors from a palette of 64 and comes with 256K bytes of video RAM.

In addition to the EGA standard, Boca's new adapter is compatible with the Hercules, CGA, and MDA graphics standards. Software included with the card includes a screen-dimmer, a software-based mode change utility, diagnostics, and a program to check the date on your ROM BIOS before installation.

Boca says that the card uses a Chips & Technologies chipset and contains fewer components than other display adapters. The result is better heat dispersion and a reduced failure rate, according to Boca. Should the card fail outside the 2-year warranty period, Boca will repair it for a set fee, regardless of the problem.

List Price: EGA by Boca, \$199. Boca Research Inc., 6401 Congress Ave., Boca Raton, FL 33431; (305) 997-6227.

CIRCLE 434 ON READER SERVICE CARD

HOT PROSPECT**Scanner Recognizes a Wide Variety Of Fonts and Runs in the Background**

An advanced page scanner from Kurzweil Computer Products recognizes virtually any font or format within a document. The Discover 7320 (\$10,000 to \$12,000 depending on memory configuration) runs in the background, so the host PC can do other work while the scanner operates.

The Discover 7320 accurately scans text and graphics from laser, daisy wheel, and letter-quality dot matrix printers, according to Kurzweil. It also handles documents created by typewriters and offset presses. The scanner recognizes fonts between 8 and 24 points in size, and is unfazed by multiple typesets on a single line or page.

Text can be output in

ASCII, DCA, or user-defined formats for further editing and formatting. Scanning speed is about 4 pages per minute, or 20 to 60 characters per second, depending on text density.

Character recognition errors can be flagged by the system and shown in the output document for user correction.

The system consists of the desktop scanner and a single-slot PC expansion board with 2 megabytes of on-board RAM.

List Price: Discover 7320, \$10,000-\$12,000 depending on memory configuration. Kurzweil Computer Products Inc., 185 Albany Street, Cambridge, MA 02139; (617) 864-4700.

CIRCLE 436 ON READER SERVICE CARD

The \$10,000 Kurzweil Discover 7320 isn't cheap, but it provides features and capabilities usually found on much more expensive scanners.

It recognizes a very wide range of fonts and typesets.

**EGA Add-on Boosts Resolution of Older Cards to 640 by 480**

EGA owners need not look longingly at the higher resolution possible with the new 640 by 480 enhanced EGA cards. Vutek Systems has introduced the \$99 EGA Deluxe Upgrade Kit, a board that raises the resolution of standard EGAs to 640 by 480.

The upgrade board does not require an expansion slot, since it plugs directly into the feature connector found on popular EGAs. Resolution is raised to 640 by 480, 752 by 410, or 896 by 350. The kit includes software drivers for 120-column text, Microsoft Windows, and 35-, 43-, and 50-line text. Drivers for AutoCAD are available for \$19.95. The upgrade kit requires a multiscreening monitor.

List Price: EGA Deluxe Upgrade Kit, \$99. AutoCAD drivers, \$19.95. **Requires:** EGA card with feature connector, multiscreening monitor. Vutek Systems Inc., 10885 Sorrento Valley Rd., San Diego, CA 92121; (619) 587-2800.

CIRCLE 438 ON READER SERVICE CARD

Blast II Brings Smooth Connectivity Between PCs and Mainframes

Easy PC-to-mainframe connectivity sounds like a contradiction in terms, but that's what Communications Research

Toshiba's 240-Pin Printer Packs New Features into a Smaller Case

Small but full-featured printers are taking over America's desktops. Toshiba America's compact P321SL, a svelte replacement for the earlier P321, offers speed, flexibility, and convenience in a downsized case.

The 24-pin printer (T749) has a built-in tractor feed, and loads paper automatically. Cut sheets can be loaded without removing tractor-fed paper. A tear bar aids in tearing sheets along the perforations instead of in half.

Toshiba/Qume and IBM Pro-printer emulations are standard, and 32K bytes of internal RAM can be used as a buffer or for downloaded fonts. Two slots on the front of the printer accept any of 14 optional font cards, or an optional 32K-byte RAM memory card. The P321SL can have up to nine fonts available to the user at one time.

Dip switches are nowhere to be found; front-panel switches



The \$749 P321SL from Toshiba offers extensive paper-handling features and a choice of optional fonts.

and 72 cps in letter-quality mode. The printer generates a 51-decibel noise level in quiet mode, according to Toshiba.

List Price: P321SL, \$749.

Optional font cards, \$79. Optional 32K memory card, \$89. Toshiba America Inc., Information Systems Division, 9740 Irvine Blvd., Irvine, CA 92718; (800) 457-7777.

CIRCLE 431 ON READER SERVICE CARD

Group says its \$250 *Blast II* software provides. The package connects minis or PCs to mainframes without additional hardware or add-in boards. *Blast II* also connects most operating systems and computers to any other PC, mini, or mainframe.

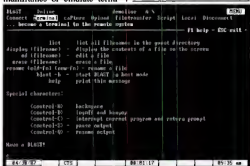
CRG says that the software works well across noisy phone lines and across satellites. PCs can transfer files error free to mainframes or emulate termi-

nals via switches, PBXs, or local area networks.

List Price: *Blast II* for the PC, \$250; for minicomputers, \$495 to \$1,295; for mainframes, \$5,500.

Requires: *Blast II*-equipped target computer or operating system. Not copy protected. Communications Research Group, 5615 Corporate Blvd., 3rd Floor, Baton Rouge, LA 70808; (800) 24-BLAST.

CIRCLE 435 ON READER SERVICE CARD



Blast II (\$250) provides error-free asynchronous file transfer across noisy phone lines and satellite links, according to Communications Research Group.

RAM Resident Utility Translates Data for Incompatible Programs

Magic Mirror from SoftLogic Solutions automatically re-formats and transfers data between incompatible programs. The \$89.95 memory-resident software captures data and stores it in a memory buffer.

Magic Mirror then transfers all of the data to the target pro-

gram as if it were coming directly from the keyboard. SoftLogic Solutions says that the whole process can take as little as a few seconds.

List Price: *Magic Mirror*, \$89.95. **Requires:** 256K RAM, DOS 2.0 or later. Not copy protected.

SoftLogic Solutions Inc., 530 Chestnut St., Manchester, NH 03101; (800) 272-9900.

CIRCLE 436 ON READER SERVICE CARD

Expansion Chassis for PC-XT Creates Dual Processor Environment

The last word in XT expansion may be the PC Link AT from HiTech Materials. It upgrades XTs to AT processing power. Standard features include an AT-compatible motherboard with eight slots, a 190-watt power supply, a 1.2-megabyte floppy disk drive with controller, and 640K bytes of RAM (upgradable to 1 megabyte).

Also standard are serial and parallel ports, and a Hercules/CGA/EGA-compatible video adapter.

The PC Link AT can be operated from the host keyboard and monitor, and it can access devices in the host.

List Price: PC Link AT, \$2,499.

Requires: IBM PC-XT or compatible. HiTech Materials, 849 Ward Dr., Santa Barbara, CA 93111; (805) 964-3535.

CIRCLE 437 ON READER SERVICE CARD

Add-on Keyboard Brings IBM Standard 101-Key Format to Older Line of PCs

Key Tronic Corp. has introduced a 101-key keyboard with the same layout as the standard keyboard issued by IBM with its enhanced AT and XT systems. The KB101 (\$159) works with IBM PCs, XTs, ATs, and true compatibles.

Like the IBM version, the KB101 has separate numeric and cursor control keypads, 12 function keys, and LED indica-

tors for the NumLock, CapsLock, and ScrollLock keys. Key Tronic says that the new keyboard will last through 100 million cycles.

List Price: KB101, \$159. Key Tronic Corp., P.O. Box 14687, Spokane, WA 99214; (800) 262-6006.

CIRCLE 432 ON READER SERVICE CARD



Owners of older PCs or compatibles can upgrade to the 101-key format with the \$159 KB101 from Key Tronic Corp.

Buddy System Turns a Regular PC into Resource-Sharing Host

PC HANDS ON

BY FRANK J. DERFLER, JR.
AND ROBERTO RIVERA

The PC Buddy System from Kano Group Industries represents a new concept in resource sharing. It doesn't have multi-user capabilities; only one station at a time can control the PC's resources. But a system of Buddy units allows connection of eight monitor-and-keyboard sets to a single PC.

The Buddy System acts as an eight-position switch that allows a selected station to control the computer. However, the same video display can be presented simultaneously at each station.

The system combines and modulates the keyboard and video signals onto a cable TV coaxial cable that can be up to 300 feet long. The units communicate to decide which one has keyboard control.

The host computer can have either a monochrome or a col-

or/graphics adapter card. The local PC monitor can be a standard PC color or monochrome unit, but the local monitors all must be composite video displays using the RCA video jack.

This system has a wide variety of uses. It can come in handy in places where there are well-equipped but underused PCs that people can share. A warehouse could be served by multiple Buddy System stations, each sharing the same computer. It can also be used to extend the monitor and keyboard of a

PC so that the system unit, disk drives, and printer can sit outside of environments hostile to computer systems.

Taking control in a network of Buddy units means having your keyboard access the PC. The video connection can remain active even when you aren't in control. Educators and trainers can use the Buddy System to allow up to eight stations to display the same screen simultaneously while rotating control for seminars.

The \$425 Buddy System



The center light on the front panel of the PC Buddy System unit burns when the host PC is free. You can press the On-line membrane button in order to tap into the host computer. The rear panel has two video ports and a keyboard outlet.

PC FACT FILE

PC Buddy System

Kano Group Industries Inc.
744 W. Hastings St., #420
Vancouver, B.C.
Canada V6C 1A3
(800) 663-8552

List Price: Startup Kit (two Buddy boxes, Cable Kit), \$425; additional Buddy boxes, \$199; additional Cable Kits, \$30.

In Short: A system that lets you tap the power of one PC from as many as eight remote terminals.

CIRCLE 481 ON READER SERVICE CARD

Starter Kit comes equipped to set up one local and one remote station over 75 feet of cable. Kano will sell the monitor and keyboard as a \$228 package.

The Buddy unit is a 5-inch-long by 2-inch-wide white box. The front panel has three indicator lamps, two touch switches, and a keyboard port. The rear panel contains two video ports, two coax cable ports, and a keyboard outlet.

This is a unique and useful way to physically extend the capabilities of any PC.

CompareRite Keeps Track Of Revisions to Text Files

PC HANDS ON

BY JOSEPH R. POLIDORO

People who write or review memorandums in progress often need to see the changes made between successive drafts. Redlining—the lawyer's method of recording changes made between drafts of documents—is ideal but costly. JURISoft's *CompareRite* now makes redlining a practical option for all professionals who write or review.

Unlike Broderbund's *For-Comment*, which lets several people annotate a document at one time, *CompareRite* lets you

compare a current version against previous drafts. Give *CompareRite* two documents written with the same word processor and it produces a third document that adjoins additions and deletions and marks them differently.

You do this through *CompareRite*'s menu, in which you name the three files (the two files to be compared and the output file), choose the appearance of the output file, and execute. Or do this straight from DOS, once you've settled on a default format, by typing "COMPARE filename1 filename2 filename3".

CompareRite has a few limi-

tations. It won't show changes in headers, footers, or footnotes. Deleted text loses all of its original formatting. For additions of eight or more contiguous pages, *CompareRite* treats the text from the addition on as new, including any original text that appears after the addition.

CompareRite supports clean ASCII and reversible-form DCA, *WordPerfect*, *WordStar 2000*, *DisplayWrite 3*, *MultiMate*, *Microsoft Word*, *WordStar*, *XyWrite*, *OfficeWriter*, and *Volkswriter*.

I used *CompareRite* on a 14-page legal document. It did in about 1 minute what took me 45 minutes with a ruler and red

PC FACT FILE

CompareRite

JURISoft Inc.
763 Massachusetts Ave.
Cambridge, MA 02139
(800) 262-5656
(617) 864-6151
List Price: \$129.95
Requires: 256K RAM, DOS 2.0 or later.

In Short: A facile text-comparer that works with nine major word processors, ASCII, and reversible-form DCA. Not copy protected.

CIRCLE 486 ON READER SERVICE CARD

pen. And the output was attractive—easier to read than the old red-inked kind. What a good alternative to Flair pens and sore eyes.



Visual COBOL.

Because
Productivity
Is The Key
To Your Future.

As a software developer, you know that productivity can often be elusive.

What you need is a tool that will reduce development time. A tool that will help you create a superior software product. The need is clear. The solution is Visual COBOL. The only COBOL with an integrated Screen Management System that can save you countless hours in total development time. Time savings. That's the

key to productivity.

For a limited time, you can try Visual COBOL **FREE** for 60 days. Call mbp today for your free copy.

800-231-6342

California: **800-346-4848**

**mbp Software & Systems
Technology, Inc.**

1131 Harbor Bay Pkwy, Suite 260
Alameda, California 94501

Visual COBOL is a trademark of mbp.

Disk Technician Promises New Life for Faulty Hard Disks

PC HANDS ON

BY MITT JONES

Prime Solutions claims its *Disk Technician* can prevent hard disk errors, repair even left-for-dead hard disks, and recover lost data—all automatically and without any technical skills on your part.

Sound too good to be true? I thought so, too. But after witnessing a few minor miracles and a major miracle or two, I'm a believer. This \$99 software may be the best investment you could ever make.

Disk Technician comes, and stays, on one floppy disk. The simple installation procedure copies your DOS system files to *Disk Technician*. You reboot your system with *Disk Technician* in drive A: to begin the program.

The first time out, *Disk Technician* runs a Monthly test, which examines each and every bit on your disk. *Disk Technician* manipulates the disk controller directly, rather than accessing the disk through DOS.

Complex algorithms, which continually refine themselves based on the performance of your disk, monitor access times. When the disk takes too long to read an area of the disk, *Disk Technician* logs that area as marginal and then runs some

further diagnostic tests.

If *Disk Technician* then judges the area to be unsafe, it attempts to repair the area by low-level formatting the track where the unsafe area was found. It then relays the track's data, tucked safely away in RAM, and retests the entire track.

Transfers Data

If the area is still unsafe, *Disk Technician* fences off the sector containing the errors and moves the data to safe harbor.

Disk Technician also maintains a database of marginal, but safe, areas and monitors these sectors very closely during future runs.

The initial Monthly test will

tie up your system for a few hours. From then on, you run the Daily test, which takes about 5 minutes, or the Weekly test, which should take less than 1 hour.

Run times will vary from disk to disk. Prime Solutions recommends running *Disk Technician* every day, but you can probably get away safely with less frequent runs.

I tested *Disk Technician* on four disks and was impressed by the results. Two weeks after running the program on my AT (*Disk Technician* had repaired two sectors and logged 17,000 marginal bytes), my system gave me a heart-wrenching File Allocation-Table error when I tried to boot up. I hadn't run

PC Disk Technician: The Low Price, On-Site Disk Doctor

DISK TECHNICIAN - AUTOMATED AT SOFTWARE SYSTEM VER-3.0 32K-1607000000

PHYSICS/DETECT/ADAPTS/RECOVERS DATA LOSSES AUTOMATICALLY BEFORE THEY HAPPEN

INCLUDE SET SAFE ZONE DOS-3.1 DRIVE-C DISK SIZE-21.3MB

RED-15,456-05% COUNTRY-E PRICES-E

| PHYSICS TEST/ANALYSIS DATES | SOFT 1 | SOFT 2 | SOFT 3 | SOFT 4 | HAZ | REPAIRED | RUN TIMES |
|-----------------------------|--------|--------|--------|--------|-----|----------|---------------|
| DAILY: 06/08/89 | 0 | 0 | 0 | 0 | 0 | 0 | 101 0 0 0 |
| WEEKLY: 06/08/89 | 0 | 0 | 0 | 0 | 0 | 0 | 101 0 0 0 |
| MONTHLY: 06/20/89 | 7 | 0 | 0 | 0 | 0 | 0 | 7 3 10 53 314 |
| TOTAL: 06/20/89 | 0 | 0 | 0 | 0 | 0 | 0 | 101 1 RUN |

TOTAL: DATE: 06/20/89-06/20/89 COUNTRY: 0-653 (ESTIM. COUNTRY: 10)

WEEKLY LATEST: HARD DISK HEAD: 0-3 TESTING: NORMAL

SELECT TEST DAILY AUTOMATIC SECTOR: 1-87 TESTING: SECTOR-ALL

==WARNING== DO NOT INTERRUPT ==WARNING== DO NOT INTERRUPT ==WARNING==

Disk Technician displays the sector it's inspecting and those repaired.

A Cure for the AT's CMI Drive?

It was little more than a year ago when *PC Magazine* ran a cover story on the disk problems that plagued, and still plague, the original IBM PC AT with CMI hard disks. Finally, there may be a cure for the infamous CMI disks.

To put *Disk Technician* to the test, I requested two recently crashed CMI disks from *PC Magazine's* equipment morgue.

I installed each disk in my AT and tried to boot, but my

system froze up the first time it tried to access the disks.

Using IBM's Advanced Diagnostics, I ran a low-level format on each disk, ran FDISK, and formatted each disk for DOS use. As expected, DOS then recognized the disks, and CHKDSK revealed no bad sectors. Based on our past experiences with these disks, I knew they were likely to crash again within a week.

I then ran *Disk Technician*

on each disk. The results were mixed but promising.

On the first CMI disk, *Disk Technician* repaired only one weak sector that DOS couldn't spot, but it reported 8,700 weak bytes it would monitor. We've been running the disk ever since without problem. The second CMI disk didn't fare so well.

Only after long-term testing will we be able to pronounce the disks cured. We'll report the results in the PC Update page in the August issue (Volume 6, Number 14).

—Mitt Jones

PC FACT FILE

Disk Technician

Prime Solutions Inc.
1940 Garnet Ave.
San Diego, CA 92109
(619) 274-5000

List Price: \$99

Requires: 256K RAM, DOS 2.1 or later.

In Short: A new approach to hard-disk care that repairs bad sectors before or after they crash your disk. Not copy protected.

CIRCLE 440 ON READER SERVICE CARD

Disk Technician since the installation.

Full of skepticism, I slid *Disk Technician* in drive A: and rebooted. *Disk Technician* repaired the problem in a matter of minutes—with no intervention on my part.

Disk Technician also repaired bad sectors on a well-used Plus HardCard 20, freeing up 40K bytes that DOS had blocked off. It reported that 68K marginal bytes were being monitored.

While *Disk Technician* can't repair your hardware, it can compensate for hardware problems such as misaligned heads, excessive thermal expansion, and plated-media inconsistencies. As a bonus, *Disk Technician* also includes an automatic head-parking routine. The initial Monthly run creates a 34K-byte safe landing zone, whether you choose to use the parking routine or not.

If you run *Disk Technician* faithfully, you may never need your copy of *Mace Utilities* again: Prime Solutions says disks using *Disk Technician* daily for 11 years of simulated use yielded no failures. But *Mace* provides some useful functions *Disk Technician* does not—such as rebuilding File Allocation Tables from scratch and restoring data after accidental disk formatting.

For an ideal arsenal against disk failures, keep a copy of both nearby. Then put your feet up and relax.



For high speed, high performance data integration, look into Magic Mirror.™

Now you can move data instantly from one program to another — right from your PC screen.

Now you can transfer parts of a spreadsheet directly into your database — or move sections of a document straight into a spreadsheet — without retyping your data, and without a single mistake.

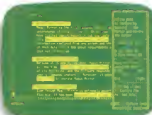
It's all done with Magic Mirror — the unique memory resident program that lets you quickly select any information directly off your PC screen and instantly feed it into any other program — in exactly the right format, with exactly the results you want.

With Magic Mirror, it's easy to do the impossible.

Let's say you're preparing a spreadsheet, and you want to include some budget information from a word processing document.

Simply use Magic Mirror to highlight those sections of the document with the information you want, and save them in memory.

Now call up your spreadsheet, hit a couple of



Highlight only the information you want to feed to another program. Magic Mirror then transfers it instantly, accurately, and effortlessly.

keys, and watch as your budget is automatically entered into the right cells — in the proper format — as though you were typing the information yourself at a blinding speed.

With Magic Mirror it's easy. Without Magic

Mirror, it's impossible. It's the complete do-it-yourself data integration tool.

The secret behind Magic Mirror is its ability to automatically edit and reformat data while it's transferring. That's significant because the way one program displays information is usually not the way another program will accept it. No problem.

Select a few simple options, and Magic Mirror removes dollar signs, inserts carriage returns and other control characters, strips out spaces — whatever it takes to make once incompatible

data look and act just like it was entered for the program you're sending it to.

Plus, it remembers everything it does — from the way it captures data, to the way it edits and reformats, to the way it transfers data. So it's simple to repeat Magic Mirror operations instantly. Or set up routines that others can use with ease.

Get tomorrow's software technology today.

Some day, far in the future, maybe all PC software will share data effortlessly from one application to another. But why wait, when you can do it yourself today at such a very low cost?

Ask for Magic Mirror at computer dealers everywhere. Or order direct from SoftLogic Solutions by calling 800-272-9900 (603-627-9900 in New Hampshire), or send the coupon below. If you find it does not meet our advertised claims within 30 days of purchase, we'll gladly arrange for a prompt refund.

**SOFTLOGIC
SOLUTIONS**



Magic Mirror
\$89.95*

Yes, send me Magic Mirror for just \$89.95* (not copy protected).

Name

Company

Address

City State/Zip

Check Enclosed ☐ VISA ☐ MC ☐ AMEX

Card # Exp. Date

Signature

SoftLogic Solutions, Inc.

One Penimeter Road

Manchester, NH 03103

800-272-9900 (603-627-9900 in NH)

Call 800-272-9900

*plus \$5.00 shipping and handling

Here's what Magic Mirror can do for you.

- Saves you time and money on communications by capturing and storing just the data you want while running on-line information services. No need to transfer complete files.
- Helps prepare reports quickly using data collected from any number of files and programs, so you get all the advantages of a pre-packaged integrated software system without its limitations.
- Gives you the most powerful integrated software system available when used along with SoftLogic Solutions Software Carousel™. A system that unifies all your favorite software.

SCSI-XT20m
Turbo XT, 20MB System,
Monochrome system

8088-2 Microprocessor, 8 MHz/4.77 MHz operation, 20MB Hard disk, 1MB PDP, High resolution, Hercules compatible, Mono Graphics adapter, High resolution (720 x 350), Monochrome monitor with tilt second base, 2 serial ports, 2nd serial port optional, 2 parallel printer port, battery backup clock/calendar, AT-style keyboard, MS DOS 3.11

\$1195

SCSI-286m
Monochrome AT Compatible System

Base System (SCSI-286, 1.2MB floppy disk drive, Hercules compatible, Mono Graphics Adapter, High resolution (720 x 350), Monochrome monitor, 1 parallel printer port

\$1145

SCSI-286s
The SCSI-286 Steal AT Compatible

Base System (SCSI-286, 1.2MB floppy disk drive, 20MB-40MB Hard disk drive, 1MB of RAM expandable to 1MB, Hercules Compatible, Monochrome adapter, High resolution (720 x 350), Monochrome monitor with tilt second base, 2 parallel printer port, 2 serial ports (2nd serial port optional), Game port, PC, Word Processor, Print Manager, Form Generator and Filing System Software

\$1699

SCSI-286 (8 MHz Version)

- Made in U.S.A.
- IBM AT[®] compatible
- 8 MHz Operation, 10 MHz Optional
- 512K, expandable to 1MB
- Also runs Xenix, Unix, Pkix, AutoCad and Network systems
- Systems are fully tested and burned in for 48 hours
- 80286-8 Microprocessor
- 80287-8 Math Co-processor optional
- Maxi[®] switch/Pro[®] keyboard

SCSI-286c
Special EGA 20MB H.D.

Base System (SCSI-286, 1.2MB floppy disk drive, 20MB/40MB Hard disk drive, EGA/CGA compatible monitor, IBM compatible EGA Adapter, and high resolution monitor, 1 parallel printer port, 2 serial ports, game port, AT style 101 key Enhanced key board

\$1895

Plus hard disk drive add \$195.

SCSI-286cs
Professional CAD/CAM System

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- 90-day money back guarantee
- Immediately delivered from stock

Monitor not included



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*19 ms access time

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| *20MB | ST4026 | \$520 |
| *30MB | ST4038 | \$628 |
| *40MB | ST4051 | \$699 |
| 80MB/28 ms | ST4090 | \$1195 |
| 120MB/25 ms | Toshiba | \$1195 |

Sengate 20/30MB Hard Disk Subsystem

| | |
|---------------------|-------|
| 20MB Internal ST225 | \$110 |
| 30MB Internal ST225 | \$699 |
| 30MB Internal ST238 | \$478 |

With Floppy Controller add \$15 (DMA only)



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- Mounting hardware
- Software and tape
- Controller included

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|--------------|-------|-------|
| TEAC 20MB | \$580 | \$794 |
| Wangtek 60MB | \$757 | \$827 |
| Archive 60MB | — | \$675 |



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- Parallel port \$178
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- Hercules Graphics
- Color Graphics

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- Uses an 80286 microprocessor on board



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- 2nd optional



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- Parallel port
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Everex Evercom 12

- Hayes compatible
- Software included
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- Excellent for Long Distance Calls

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- Half size/Low power
- 1200/2400 Baud internal
- Software included
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- Excellent for Long Distance Calls



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- Makes your PC/XT 3% faster than IBM
- 80286 processor
- Socket for 80287
- 128K RAM



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Everex Edge

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- color software thru video monitor



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- Work with Auto CAD
- 3 button/built-in microprocessor



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Mouse with DR. HALO \$109

HD/Floppy controller

- Hard disk & Floppy controller for AT \$160
- PC/XT Hard disk & Floppy controller \$120
- PC/XT Western Digital (chipset) Hard disk controller \$160



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- 800H x 150V resolution
- FCC class "B" approved

EGA monitor

- 640 x 350 \$429
- 640 x 200
- EGA and CGA

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■ QUICK LOOKS

On-screen Help for DOS at Two Levels

PC HANDS ON

BY EDWARD MENDELSON

Too much trouble to reach for the DOS manual? Can't find what you need when you flip through it? A few keystrokes can bring you *DOS Help* or *TECH Help*, both from Flambeaux Software, and you can browse around in electronic manuals instead.

Both programs pack the screen with text, with key phrases highlighted. You put the cursor on a keyword, press Enter, and move deeper into more-detailed treatment or sideways to a different topic. *DOS Help* supplements the standard DOS manual with explanations, warnings, and examples, and throws in useful information

from the DOS *Technical Reference* manuals like ANSI escape sequences and ASCII codes. It does get long-winded in some places, but virtually everything

that you need is there.

TECH Help gives programmers an encyclopedia of details from the DOS and hardware *Technical Reference* manuals



When a DOS manual isn't handy, *DOS Help* can provide explanations and examples of DOS commands such as EXE2BIN.

and other sources, much of it undocumented, and all of it in more straightforward prose than you get from IBM or Microsoft. It describes DOS interrupts and functions, file headers, switch settings, video attributes, I/O control, differences between DOS versions, and much more.

Both *Help* programs can be run from the command line or made resident. When resident, both programs pop up over the full screen, so you'll have to write down any complicated information that you want to use afterward.

List Price: *DOS Help*, Version 3.2a, \$34.95; *TECH Help*, Version 3.2a, \$69.95.

Requires: 64K RAM (256K RAM for use as resident program), DOS 2.0 or later, Flambeaux Software, 1147 E. Broadway, #56, Glendale, CA 91205; (818) 500-0044.

CIRCLE 426 ON READER SERVICE CARD

R:Bridge Opens Link to R:base Files

PC HANDS ON

BY NEIL J. RUBENKING

The *R:base* file structure is something of an enigma compared with those of competitors such as *dBASE*. One enormous *R:base* file holds the data for all tables, another holds all of the index keys, and a third one holds the database structure. This approach has its advantages, but it makes reading the files with an external program quite difficult.

Full Access to R:base

R:Bridge System V, from Synchronicity Research Group, gives full access to any *R:base System V* database from Turbo Pascal, QuickBASIC, or C. I tested the Turbo Pascal version and, in one day, starting with no knowledge of *R:Bridge*, I was able to duplicate a complicated command file. The original took over a week to create in *R:base Series 5000*, another week to debug, and nearly another to convert to *R:base System V*. It took 4 hours to run,

versus 1½ hours for the converted program.

A program involving more analysis and less actual database access would speed up even more. The *BRIDGE* program runs as a DOS shell around your application and supports the essential database operations. A

full set of conversion routines transform all the *R:base* data types into types compatible with your language.

The manufacturer requires no royalty when the program is distributed with databases, so programmers will have good reason to travel this bridge.

List Price: *R:Bridge System V*, Version 2.0, \$450; multiuser option, \$150 per server; *R:base Series 5000* version, \$395.

Requires: 256K RAM, hard disk recommended, *R:base System V*, DOS 2.0 or later, Synchronicity Research Group, 66 Witherspoon St., Princeton, NJ 08542; (609) 683-9233.

CIRCLE 427 ON READER SERVICE CARD

XT and AT Installation Made into Video

PC HANDS ON

BY ELLEN R. S. BUSH

Although there are no Academy Award nominations in sight, PC Star Productions' *PC TechVideo* is a movie that tells a story. The first 2-hour videocassette in this two-tape set explains, in great detail, the components and workings of the PC. The presentation is somewhat boring, but for anyone who wants to find out more about how the machine works, it is definitely worth watching.

The second tape covers maintenance and assembly of a

personal computer. Both the XT- and AT-compatible computers are disassembled and reassembled. This two-system approach reinforces the material and emphasizes differences between the two machines, but encourages use of the VCR's fast forward button. A few bugs are left in the computer to better illustrate the explanation of system testing.

Amateurish Production

The videocassette recommends a number of reference books, but some written material is included in the package. An outline would be quite helpful in

determining viewing needs. The production is clearly amateurish: the narrator is not a trained speaker and the filming is rather low-budget. However, the low-quality film-making is offset by the very clear, simplified explanation of some mystifying topics in a product that meets a definite need.

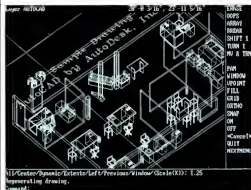
List Price: *PC TechVideo*, \$89.95, plus shipping costs. **Requires:** Betamax or VHS videocassette recorder, PC Star Productions, 1040 E. Chapman Ave., Orange, CA 92666; (800) 438-8877, (714) 771-3560 (in Calif.).

CIRCLE 428 ON READER SERVICE CARD

■ PC UPDATE ■ PEGGY GAVAN

In an effort to pump life into its 5-year-old word processor, Ashton-Tate has released **MultiMate Advantage II**. The new version offers a choice of page or document orientation, the ability to merge dBASE files without leaving **MultiMate**, an undo-delete function, and increased laser printer support. The software also comes with the **MultiMate On-File** mailing-list manager. **MultiMate Advantage II** is priced at \$565 for the 5¼-inch disk version, down \$30 from Version 3.60. A Premium Pack, containing both 5¼- and 3½-inch disks, is priced at \$595. Upgrades are available for \$100. Ashton-Tate, Torrance, Calif.; (800) 367-8126.

AutoCAD, Version 2.6, has several new enhancements, including 3-D Level 2 for the generation of three-dimensional lines and plane sections, plus transparent pan, view, and zoom commands. The new version also features associative dimensioning of objects that automatically updates drawing dimensions whenever an object is scaled, stretched, or rotated. In addition, Version 2.6 adds driver support for Vermont Microsystems' **Image Manager 1024** display and the Hewlett-Packard **Draftmaster E-size** and **Draftpro D-size** plotters. Registered users of Version 2.5 or 2.52 can upgrade to Version 2.6, priced at \$2,850, for \$100. Autodesk, Sausalito, Calif.; (800) 445-5415, (415) 332-2344.



AutoCAD, Version 2.6, adds 3-D Level 2 for the generation of three-dimensional lines and plane sections and supports additional HP plotters.

Laser Fonts, Version 2.0, works with **WordPerfect**, **WordStar 2000**, **Microsoft Word**, **Fancy Font**, and **Fancy Word** to print downloaded HP or SoftCraft fonts, cartridge fonts, and built-in printer fonts. In addition the new version adds bitstream fonts, including Times Roman, Helvetica, and Courier. Included with **Laser Fonts 2.0** is the **SoftCraft-to-HP Font Conversion Program**, which converts SoftCraft fonts to HP Soft Font format in portrait or landscape orientation. Registered users of all SoftCraft products can upgrade for \$25. SoftCraft Inc., Madison, Wis.; (800) 351-0500, (608) 257-3300.

Media Cybernetics has enhanced its **Dr. Halo II**, **Halo DPE**, and **Nimbus** programs to take full advantage of the **Personal System/2**'s advanced resolution and color capabilities. The 3½-inch disk format for each program is available to registered users for \$50 plus shipping. Media Cybernetics Inc., Silver Spring, Md.; (301) 495-3305.

Rodime Systems has released an enhanced version of its **R-Card 45** hard disk card for the IBM **PS/2 Model 30** and the **PC AT**. The original 45-megabyte hard disk card worked only with the **XT** and

An enhanced version of the Rodime R-Card 45 is now available for use with IBM PC ATs, AT compatibles, and the IBM Personal System/2 Model 30.



compatibles. Rodime is shipping the R-Card 45, priced at \$1,495, with both 5¼- and 3½-inch software floppy disks for **XT**, **AT**, or **Model 30** operation. Rodime Systems, Pepper Pike, Ohio; (216) 765-8414.

Consumers Software has upgraded its **Network Courier** electronic mail package to **Inter-Network Courier**. The new version has a "post office" feature that routes messages between different servers on a single network or between different networks via modems. Current users of **Network Courier** can upgrade to **Inter-Network Courier**, priced at \$995, for \$300. Consumers Software Inc., Santa Cruz, Calif.; (800) 663-8935, (408) 426-7311.

Barrington Systems has released the **Clarion Translator** compiler module for use with its **Clarion** applications development system. The new module produces relocatable Intel 8086 native-code object modules from files produced by the **Clarion** compiler. These modules are then linked with the **Clarion** object library to produce .EXE files executable directly from DOS. The **Clarion Translator** is priced at \$95. Barrington Systems, Pompano Beach, Fla.; (305) 785-4555.

In brief: Leading Edge has reduced the price of its single-drive **Model D** with monitor from \$1,195 to \$995, and its dual-disk-drive version with monitor and word processing from \$1,295 to \$1,095. Leading Edge, Canton, Mass.; (800) USA-LEAD . . . Bizcomp Corp. has reduced the price of its modems by up to \$100. The **IntelliModem XT** and the **IntelliModem EXT** modems, originally priced at \$549 and \$499, respectively, are now both \$449. The **IntelliModem ST** remains at \$449. Bizcomp Corp., Sunnyvale, Calif.; (408) 733-7800 . . . G.O. Graphics has upgraded its **DeskSet** desktop publishing program to the **DeskSet Design Edition**. The new version does not require the use of a page description language and outputs both type and graphics to Compugraphic typesetters and laser printers. **DeskSet Design Edition** is priced at \$1,295; the PostScript version of **DeskSet** is still available for \$995. G.O. Graphics Inc., Burlington, Mass.; (800) 237-5588 . . . American Small Business Computers has released **ScanPro**, a software package that reads scanner-produced images and converts them to formats readable by **ProDesign II** and **AutoCAD**. **ScanPro** is priced at \$595 and \$995, respectively, for the two CAD systems. American Small Business Computers, Pryor, Okla.; (918) 825-4844 . . . **Automenu**, Version 4.0, adds a menu-building facility for faster creation of menu definition files and adds automatic execution of commands at preselected times. **Automenu** is priced at \$50; registered users can upgrade by paying the difference in price between earlier versions and 4.0. Magee Enterprises, Norcross, Ga.; (404) 446-6611 . . . Condor Computer has cut prices on two of its database programs. **Condor 3** dropped \$155, to \$495, while **Condor Jr.** was reduced \$96, to \$99. Condor Computer Corp., Ann Arbor, Mich.; (313) 971-8880.

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* Quicken's Transfer is included on the Apple program disk. The IBM version comes on a separate disk costing \$25.

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—InfoWorld Review Board

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—Ken Landis, A+ Magazine

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CIRCLE 151 ON READER SERVICE CARD

Truth in Advertising

MicroHelp of Marietta, Ga., says its \$65 programmer's utilities, *The Inside Track* (Dvorak should sue), will, among other things, "turn your computer into an expensive alarm clock."

Hyperbole Dept., Nerd Division

"The 80386 chip. The 'big bang' that's put the speed and power of a minicomputer into a desktop PC. As awesome as the creation of the universe, the 80386 signals the beginning of a new generation of computers."

—The Software Link ad for PC-MOS/386

And Half an Hour Later Your Hard Disk Crashes?

Slip of paper inside a Westchester County, N.Y., Chinese restaurant fortune cookie: "New encounters could change the course of your file."

Maybe It Went for the Motel Bills



The Rev. Jim Bakker explained the disappearance of \$13 million in Praise the Lord (PTL) church funds to the IRS by saying the Devil got into the PTL's computer.

A Cheap Trick (Wish We Had Thought of It)



The inaugural issue of *PC Clone* magazine inadvertently included five pages of nude photographs from *Playboy*.

Supercalifragelisticexpialidocious Meets Its Match

"Truevision is a registered trademark of AT&T. Truevision design and development by:

RADAKAKACCCEJHDHJBHBJCMGBMPL-
RASJSJSBSJW."

—AT&T Truevision ad



User-Supported Shareware: DOS

"The OS/2 operating system that is to replace MS-DOS, [which was] always a freebie, will cost \$325 to \$795 . . ."

—The New York Times, April 5, 1987

Solid as Sears

A Sears ad in the March 25 *Bremerton* (Wash.) *Sun* advertised a PC-compatible Franklin computer and a "monochrome color monitor."

Heard or seen anything offbeat, unusual, or just plain dumb about the computer industry? Send your offerings to *Communicate*, PC Magazine, One Park Avenue, New York, NY 10016, or MCI Mail 157-9301. Contributors receive \$50 and a PC Magazine T-shirt. In case of duplicate entries, the earliest postmark prevails.

Please, please, please—no more buzzed rib-tickers like "hardware" (horrible), "Canon printer" (yaffew), "dot merrica" (heh-heh), or "sloppy disk" (snort). Contributors to this issue: Kevin A. Roberts (PC-MOS/386), D. G. Kisinger (Truevision), Joe Kasper (fortune cookie), Joseph Gonzales (multi-maid program), Ken Hudson (D Bore 3), Gail Foreman (monochrome color), Russan Herrmann (alarm clock), Steven Chabrot (slobs), Doug Feltz (quality limited), John C. Velthe (Co-bolt, 4-Trans), R. Lucas (eternal drive).

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—The New York Times, March 29, 1987

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Good typing and steno also required. Experience IBM PC, multi-maid program, excellent pay.

—The San Juan Star, February 22, 1987

CAMP FIELD
ACCOUNTANT

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—Winnipeg Free Press, January 24, 1987

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—Kansas City Star, March 8, 1987

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—The Intelligencer Journal (Lancaster, Pa.)

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tual memory up to 64 million Megabytes.

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■ FROM THE EDITOR'S SCREEN ■ BILL MACHRONE

WHAT HAPPENED TO OFFICE AUTOMATION?



Office automation once held forth the promise of the paperless office, videophones, teleconferencing, and much more. So what went wrong?

You remember Office Automation. It was big rooms with neat rows of Vydec word processors, each run by an earphoned clerk connected to the central dictation unit.

Or was it Wang commercials on Sunday afternoons, in which men and women in silver Spandex jumpsuits and chrome helmets spoke to Big Brother-ish images on a wall-sized screen while the occasional piece of paper emerged from a slot in the wall and rainbows of laser beams leapt from the window to points unknown?

Or was it your IBM rep's nirvana of Mag Card Selectrics and MT/STs, with the wholesome girl next door pressing a key on the System/34 console, her face radiant with hope and expectation?

Or was it the television studio with the conference table, in which executives addressed the monitor, saying, "Here, Jim, take a look at these figures," and handed a page to an off-screen assistant who fed it to a fax machine so that it could emerge in an identical conference room/studio somewhere else on the planet?

SYSTEMS ARCHEOLOGY Someday an archeologist with an interest in the beginnings of the Information Age will unearth a linen-backed three-ring binder and joyfully exclaim, "Look! A DOS 3.2 manual. What a find!" Only he'll pronounce it "dose." In the same way, we can look at the garbage heap of history to see where we've come from.

Let us now recite in hushed tones the names of some of the dearly or nearly departed: Burroughs Redactron, NBI, Vy-

dec, Lexitron, Lanier, CPT, Compucorp. They share a common fate—they were sure of the future. Not all these companies are out of business, but they're out of the business they thought they were in.

Word processing was the pivot upon which OA turned. The gains in productivity and appearance were obvious, even though they were fueled by machines the size of a freezer chest, and the output devices were jury-rigged Selectrics that shed parts or ate the furniture if you pushed them past 10 characters per second. Identifying word processing as a task, a vertical function that extended horizontally across all organizations, was the final triumph of the 1950s efficiency experts. It also potentiated the role of women in business.

OA was perfectly timed with the women's rights issues that emerged in the sixties. It created career opportunities for women that simply didn't exist beforehand. While women were just as intelli-

gent 30 years ago as they are today, they were often relegated to secretarial roles in which they filled coffee cups as often as they corrected the boss's grammar. Despite the fact that many had college degrees, women had a tough time getting out of the secretarial scene. Word processing departments created a new series of supervisory jobs. Companies were quick to discover that women who were successful running the WP pool were equally as capable running the purchasing department or a manufacturing line.

The WP department was also a major way to go up-and-out. Many capable operators were recruited by equipment vendors to become trainers. They, of course, worked in tandem with field sales reps and it wasn't long before they started picking up sales responsibilities. The most talented and determined ex-operators leveraged their new freedom into support businesses, consulting, newsletters, and roles in marketing and product planning.

Office products dealers also reached for OA as a way to leverage their positions. OP alternates from glamorous to grubby as one market after another has grown, matured, and slipped away. OP dealers, for instance, rode the crest of electric typewriter sales but always played second fiddle to IBM's powerhouse field sales force. Likewise, they ate Xerox's crumbs for years in the copier business. Electronic calculators were once the private domain of OP dealers—until they showed up in Radio Shack and grocery stores. Small wonder that OA looked like the road to salvation, a respite from index cards, pencils,



■ FROM THE EDITOR'S SCREEN

erasers, and Bic pens by the gross.

Once again, OP dealers came in behind the larger OA companies, the ones that could afford outbound sales forces. The only portion of OA that they could ade-

quately deal with was dedicated word processors. These, of course, have been soundly trounced by PCs.

How many of these ups and downs can the OP channel stand? In the past 5 to 7

years, an incredible amount of junk has been foisted off on the OP channel: crude memory typewriters, dedicated word processors, and "improved" PCs that were so incompatible as to be laughable. Still, hope springs eternal in the human breast. OP dealers flocked to OA products and cast themselves as value-added dealers. Support costs a lot of money. I wonder how many of them went broke under the strain?

The sad thing is that many OP dealers have gravitated to proper PCs, but see themselves quite differently from computer stores. They're still mired in OA thinking because they're still replacing outmoded dedicated word processors. In an effort to differentiate themselves from the retail and mail-order PC channels, they're ignoring the state-of-the-art software available for the PC and, for heaven's sake, still developing proprietary word processing packages. Their argument is that it outperforms the OA products. That's fine, but it doesn't make the grade against today's market leaders. They're trying to beat the wrong competition.

FACING FAX The PC is doing a phenomenal job of breaking facsimile out of its "fuzzy characters on smelly paper" mode. You can now prepare documents with virtually any word processor, and the PC can transmit them to a fax machine. The quality is noticeably better than fax-to-fax transmissions. On the other side, your PC can receive fax transmissions and print them on an ordinary printer. Again, there are big gains in quality. OA always promised us comprehensive mail services, with equal attention to voice, electronic, and paper. All but the largest, most well-heeled corporations have shied away from the enormous capital investment and start-up costs implicit in a comprehensive mail system. PCs, meanwhile, have made significant inroads, first into electronic mail, and now into fax. Some products, such as Watson, also do a credible job of personal voice mail.

Office automation: we've got a lot to be thankful for, but not much to show for it. Maybe it's time to rethink the traditional top-down approach to office automation. The PC has made all of its gains from the bottom up.

□

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| SPREADSHEET MANAGERMENT | |
|---------------------------|----|
| Desktop & Server software | \$ |
| Tobias Management Tools | \$ |
| Microsoft Excel 3.11 | \$ |
| Microsoft Excel 4.0 | \$ |
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| GRAPHICS SOFTWARE | |
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| Microsoft Paint 2 | \$ |

CONCLUSIONS

[illegible]

TERMINALS

| Qune | TERMINALS | |
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| 101 Plus Green | | \$ 315 |
| 101 Plus Amber | | \$ 315 |
| Wye | | |
| 30 | | 285 |
| 50 | | 305 |
| 75 | | 345 |
| 85 | | 425 |
| Bernoulli Box | DISK DRIVES | |
| 10 Meg | | \$ 985 |
| 20 Meg | | 1199 |
| 40 Meg | | 1729 |
| Seagate 20 MG w/HD Controller | | 1399 |

NEW DRIVE

| | |
|--------------------------------|--------|
| 10 Meg | \$ 865 |
| 20 Meg | 1199 |
| 40 Meg | 1729 |
| Seagate 20 MEG w/HD Controller | 339 |

NOTE

| Anchor Automation | | MODELS | |
|-------------------|-------|--------|--------|
| Anchor Express | | | \$ 185 |
| Hayes | | | |
| All Models | | | Call |
| Prometheus | | | |
| i2000 w/Software | | | 129 |
| US Robotics | | | |
| Forward 1200 | | | 149 |
| Coupler 2400 | | | 335 |
| Microline 2400 | | | 335 |

INTEGRATIVE SOFTWARE

| INTEGRATIVE SOFTWARE | |
|-----------------------------------|----|
| Ability | \$ |
| Enable 2.0 | |
| Frontier 8 | |
| PS, 1st Choice | |
| Secure Software System 3.0 | |
| Symphony | |
| GRAPHICS/ICE | |
| Harvard Presentation Graphics | |
| IMS Mouse (PC Mouse) w/DI Halo II | \$ |
| Microsoft Busi Mouse v.0 | |
| Microsoft Chart | |
| Microsoft Serial Mouse v.0 | |
| PC Bus Plus Mouse (Mini Ver) | |
| PC Mouse (New Ver) | |

PROJECT MANAGER

| PROJECT MANAGEMENT | |
|--------------------|---|
| 19 | Harvard Total Project Manager II \$29 |
| 00 | Microsoft Project \$21 |
| 03 | Super Project Plus \$6 |

LANGUAGES

| LANGUAGES | |
|----------------------------------|----|
| Basic Compiler (Microsoft) | 62 |
| C Compiler (Microsoft) | 24 |
| Cobol Compiler (Microsoft) | 30 |
| Fortran Compiler (Microsoft) 4.0 | 34 |
| Genrel | 18 |
| Lector C Compiler | 23 |
| Macro Assembly (Microsoft) | 30 |
| Ran C Interpreter | 30 |
| System Information Translator | 30 |
| Visual Basic Compiler | 30 |
| Pascal Compiler (Microsoft) | 30 |
| Quick Basic 3.0 | 30 |
| Turbo Asmco Pack (New View) | 15 |
| Turbo Pascal v=8087 & 8088 | 2 |
| Turbo Prolog | 30 |
| Turbo (Database Tool Box) | 30 |

- No Charge for **WTB & Mastercard**
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 • Personal and Company Checks with Delay Shipping 3 Weeks
 • Prices, Terms and Availability Subject to Change without Notice
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 • All Sales Are Final
 • We Do Not Guarantee Machine Compatibility

- **Order Line Hours:** Mon-Fri 8:30 a.m.-5:30 p.m.
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- **Order Processing:** (802) 461-8020 Mon-Fri 10:00 a.m.-3:00 p.m.

CIRCLE 123 ON READER SERVICE CARD

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which gives you a digital
read out of the actual
number of millions

of instructions per second
currently being processed.

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is what you'd expect from
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unit also comes

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support Hot Line gives you
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staff.

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CIRCLE 527 ON READER SERVICE CARD

THE WORLD'S SMARTEST ANSWERING MACHINE

PERSONAL VOICE MAIL

"Hello. I'm not available right now. Please wait for the tone and leave a detailed message. Touch the star to listen to what you've recorded."

PERSONAL MESSAGES FOR FREQUENT CALLERS

"Hello, I'm not available... Dad! I'm not here, but my computer knows exactly where I am and will pass your message on to me immediately. Wait for the tone and tell me where you are. I'll call you right back."

REALLY PERSONAL MESSAGES FOR FREQUENT CALLERS

"Hello, I'm not available... Tess! Sweetheart! I'm in the car, picking up your flowers. My car phone number is 993-1234 if you need me. Otherwise, see you at seven. Kiss-kiss-kiss!"

MESSAGE FORWARDING

"Hello. This is your answering machine calling... Three new messages. Message one was received at 3:52PM today."



MULTIPLE VOICE MAIL BOXES

"Hi. This is the operating systems group. We're out to lunch, but you can leave a private message by dialing 11 for Chip, 12 for Morris, 13 for Joel and 14 for Bob. Or you can wait for the tone to leave a message for our secretary."

INCREASED SECRETARIAL PRODUCTIVITY

"This is Gordie's voice mailbox. Please wait for the tone and leave a message. My computer knows where I am at all times and will call me immediately with your message. If you need to speak to someone right away, touch zero to transfer to my secretary."

DON'T FORGET MOM!

"This is Chip. Please... Hi, Mom. I've been waiting for your call. How's Europe? Thanks for remembering my birthday. Sorry I missed you, but I had to run some errands. See you Thursday at the airport."

OUTGOING MESSAGES

"This is Joel's computer calling. Just a reminder for Lynne and Bonnie - We have a budget review tomorrow morning at 8:00 o'clock. See you there."

Answering machines are irritating because they are so dumb. Even the best of them. For only \$349, we'll give you personal voice mail for your PC, and turn it into the world's smartest answering machine. All without disturbing whatever else you've been doing on the PC.

How smart is "smartest?" The examples above... uh... speak for themselves. Sure, your PC can answer the phone in your voice, and let you retrieve messages remotely from any touch-tone phone. And it can call you to deliver your messages.

But give your friends and associates their own voice mailboxes. The ability to interrupt your greeting and start recording immediately. To deliver messages to each other as well as to you. The ability to transfer to other extensions. Even let them change their minds and their messages. Give them

all this and you'll never again have to apologize for making people talk to a machine.

In your business, it will relieve your secretary of the burden of taking routine messages. And relieve you of the burden of transposed telephone numbers. In business or in personal use, it works 24 hours a day. Without irritating your callers like mere answering machines do. All while you're running your spreadsheet, word processor or just about anything else.

We call the world's smartest answering machine "CAM." For Complete Answering Machine. We call ourselves The Complete PC. And CAM is just the beginning of a whole line of smart products designed to help you get more from your personal computer.

You should call (800) 634-5558 today for the name of the CAM dealer nearest you.

So tomorrow, you can give your old answering machine to someone who doesn't mind annoying people.



THE COMPLETE PC

More from your personal computer

521 Cottonwood Drive • Milpitas, California 95035
800 634-5558 • 408 434-0145 • FAX 408 434-1048

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CIRCLE 110 ON READER SERVICE CARD

■ JOHN C. DVORAK

IBM'S NEW SHILLS: A DISASTER WAITING TO HAPPEN



IBM's new advertising campaign for the Personal System/2 is an indication that a misguided trend may be taking root again. Paging the Little Tramp.

The use of well-known Hollywood personalities as shills and pitchmen doesn't come cheap, and the computer industry is one of the few businesses that can afford to use them. I think there are better ways to spend money. But don't tell that to IBM.

IBM has just jumped on this dubious bandwagon with its new mascot team, the crew from the old, dead TV show "M*A*S*H." It's nuts. These ads may adversely affect company sales and market share. It's an important event to follow.

I'm not sure who the first computer shill was. It may have been Bill Cosby barking dogma for the defunct Texas Instruments 99/4. Or it may have been Bill Shatner, L.L.K. (looking like Kirk), pushing the old Commodore 64 (or was it the VIC-20?). Soon thereafter Tandy used Texas logic and figured the commonality and key to this marketing ploy was obviously "some guy named Bill," and so they hired Bill Bixby to promote the Tandy computers. Soon Alan Alda (noticeably missing from the IBM/M*A*S*H consortium) came along and conformed his way through a series of forgettable ads for Atari. The peak of this nonsense was reached when Dom DeLuise was showcased by NCR for its line of PCs. Sales of PCs skyrocketed during this campaign. Too bad it wasn't sales of NCR PCs.

In fact, during this period of spokesperson mania, the big winner in the sales sweepstakes was IBM. It avoided big-name company shills and instead licensed the image of Charlie Chaplin's Little Tramp. He didn't talk. Over time, some

company insiders would say the character trivialized the products and made a mockery of the company's image. Now it looks like he's out and perpetually yakking actors are in. It may be a mistake, if we judge from the past results of the use of this technique.

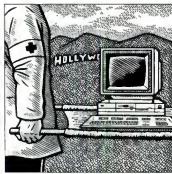
To make personalities work in advertising, they have to be associated with the industry or product. Bill Cosby can sell Jell-O—it's a consumer product that needs little expertise to understand. But who believed him as a spokesperson for Texas Instruments—especially after he said the TI was better than the Apple II because it had "more cartridges"? The Apple had no cartridges because it was a floppy-disk machine. Who was he kidding? Andy Granatelli can sell auto parts and Michael Jordan can sell gym shoes. But can these people sell machine tools? I don't think so. Neither can Jack Nicholson, Faye Dunaway, Warren Beatty, or the crew from

"M*A*S*H." So who figures they can sell computers? Think again.

Try to remember any complex product ever sold by famous actors. Most of the time you remember the personality, not the product. I can never remember what car James Garner keeps pushing (Toyota? Mazda?). Big winners as product spokesmen have been characters played by working actors (or cartoons): the sad Maytag Repairman, Mr. Goodwrench, Mr. Clean, the Ty-D-bol Man, Speedy Alka-Seltzer, the fat Round Table Pizza guy, and Madge the manicurist ("you're soaking in it"). While none of these are complex products (with the possible exception of the washing machine and toilet chemical), they are still better represented (and remembered) through fictitious characters.

THEY DO IT FOR C*A*S*H The fact is that, subconsciously, the viewer knows that an actor boosting IBM is doing it for dough. Who believes any of these "M*A*S*H" jokers can even boot a computer? You imagine they all pronounce the operating system as "dose" and all talk about a place called Silicone Valley. It's somehow offensive.

The viewer is more likely to warm up to a cold-fish CEO like Lee Iacocca. We know for sure that he is sincere about his company. My advice to IBM: go back to a fictitious character or use a cartoon. Let John Akers do the ads or get one of the Watsons. Even John Opel's daughter would be better than a famous actor. If that fails, then I suggest IBM use Mr. Ed, the talking horse.





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■ JOHN C. DVORAK

INSIDE TRACK

Junk power supply scams worsening, more IBM PS/2 machines waiting, and 386 bugs require remasking.

Y**ou Can't Find a Bad Cognac Dept.** Here's a challenge for marketers: try and find a bad cognac. It's nearly impossible because the producers in that brandy-growing region have a reputation to uphold, and they'll cut the nose off of a producer that doesn't meet their standards of excellence. Even the cheapest cognac is a good drink.

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| Microsoft Fortran | 249 |
| Microsoft Macro Assembler | 84 |
| Microsoft Quick Basic | 59 |
| Turbo Pascal | 55 |

PROJECT MANAGEMENT

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| Super Project Plus | 259 |
| Time Line | 219 |

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| Great Plains | 366 |
| Managing Your Money | 105 |

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| Fast Back | 84 |
| Fixed Disk Organizer | 45 |
| Microsoft Windows | 55 |
| Norton Commander | 36 |
| Norton Utilities | 48 |
| PC DOS 3.2 | 69 |
| Sidekick | 47 |
| Sideways | 34 |
| Smart Com II | 75 |
| Superkey | 38 |

SPREADSHEET/ INTEGRATED

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| HAL | 89 |
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| Lotus 3.5" Ver. | 315 |
| Lotus Metro | 55 |
| Lotus Report Writer | 99 |
| Microsoft Multiplan | 105 |
| Smart Integrated | 429 |
| Supercalc IV | 265 |
| Symphony | 439 |

■ JIM SEYMOUR

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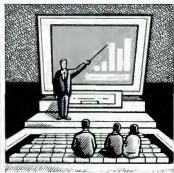
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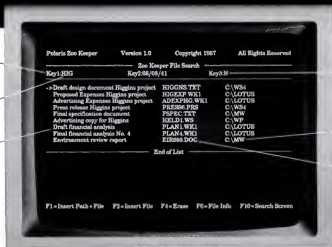


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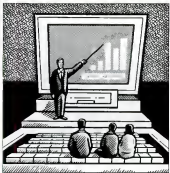
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Fourth and finally, better video projection systems are slowly emerging and, more important than the increased quality of the projected video image, the number of installed video projectors is increasing

dramatically. Not long ago, using a video projector usually meant I had to arrange to rent one well in advance and have it delivered to "the site." Now, more often than not, I find companies already have video

projectors installed in one or more of their conference rooms.

Usually, a more-or-less-dedicated PC is already connected to that system, so in theory all I need when I walk in the door is my slide show on a disk. But because I need the presentation program itself to run the program—and because I love the flexibility of doing last-minute updates and changes—in practice I usually carry along a portable computer with slide show data-files and the program on its hard disk. With an RGB video-output jack to drive those video projectors available in almost every portable PC, I don't have to worry about copying files onto the dedicated PC: I just plug the cable from the projector into the back of the portable.

And I can always run the show on the portable's built-in screen if something goes wrong with the video projector.

■ Even people who sneered at the idea of PC-based slide shows a few months ago are starting to come around with interest and grudging admiration.

Over the last 6 months or so I've seen at least 20 good desktop presentations—created not by corporate art departments but by individuals who used and liked PCs and had a need to explain something or persuade somebody. Those people quickly became very popular among their colleagues, whose "I didn't know you could do that on a PC!" was quickly followed by, "Uhh, I was wondering, could you help me put together a little . . . ?"

That sounds to me like a market that's about to go big-time. The Big Five applications can rest easy; their club is hard to break into. But desktop presentations are going to push hard into the second tier of important PC uses.

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■ STEPHEN MANES

CD-ROM CHICKENS AND CD-ROM EGGS



Conflicting standards still prevent CDs from living up to their full data-packing potential. Maybe it's a software problem; maybe it's a hardware problem . . .

"It sounds like a poultry convention," said one wag at Microsoft's second CD-ROM conference. "All I keep hearing about are chickens and eggs."

Eggactly. In certain quarters the CD-ROM has been touted as the wave of the future—for a few years now. Elsewhere it's dismissed as "too much technology and not enough" or "a solution in search of a problem." The only consensus I can glean is that there is no consensus.

Some 500 megabytes of data—1,500 floppies, 16 30-meg hardfiles—fit onto a single CD-ROM, a little slice of plastic that looks exactly like a plain old audio compact disc. It's a read-only medium, and you can't just slap a CD-ROM disk in a cheap CD audio player and expect to decode it simply by adding some sort of out-board device. Current CD-ROM players are expensive, about \$700 retail; to ease the pain, some can play CD audio too.

To further complicate matters, CD-V (compact disc video) players should arrive this fall. They're designed to play special disks that include 5 to 7 minutes of analog video and digital audio plus 20 additional minutes of digital audio along with a still frame from the video. Teen dream! A music video and an album all in one! But these players, which will play audio CDs, won't play CD-ROMs unless they're specifically designed to.

Philips has also standardized on something else called CD-I (compact disc interactive), which requires yet another kind of player—one with a built-in Motorola 68000-series microprocessor. It can dis-

play digital TV-quality images, but not full-screen, full-motion ones. Low-end machines will decode CD-ROMs but not CD-V; pricier models might do it all.

Microsoft doesn't much care for CD-I, in part because Microsoft writes operating systems for Intel chips and CD-I requires the OS-9 operating system for its Motorola 68000. However, GE/RCA has just announced a chip called DVI (digital video interactive). This little monster is an ultra-high-performance video computer, specifically designed to decode a full hour of full-motion, full-screen digital video and audio from a single CD. It also has all sorts of image manipulation talents and interactive possibilities. Since it's fully compatible with MS-DOS, you can imagine how Microsoft feels about it. The live demonstrations of DVI were the hit of the conference. It may have killed CD-I in the womb; it may end up going nowhere.

That's because two disparate visions of

the CD's future have emerged. The first is already in operation: the CD-ROM as data vessel. If the information fits, CD-ROM is a dandy way to disseminate it. Many catalogs and historical databases are already available in this form. The read-only technology is just fine for data that needn't be updated more often than once a week. If players become commonplace, individual CD-ROMs could even replace the multiple-floppy-disk software distribution headaches that are clearly going to get worse as programs get bigger. But this is obviously a parochial use of the CD-ROM technology.

The fancier model is interactive digital video as "whizbang," delivering giant hypertext databases and flashy educational tools. Although interactive entertainment has been moribund since the video game succumbed to the onslaught of MTV, some pundits claim a "whole new medium" is upon us. GE/RCA's demo of a high-powered flight simulator and an ugly Sesame Street alphabet program, however, did not exactly break new ground.

But even as mere vessels, CD-ROMs have a lot going for them. They can dramatically save space; a law firm with its office library on CD-ROM might be able to scrimp on the rent. Per unit of data, CD-ROMs are orders of magnitude cheaper to produce than books, and they're supposed to be virtually indestructible (though rumor has it their vaunted permanence may still be only theoretical). CD-ROMs could be terrific at minimizing demands on costly mainframe time in systems that make frequent accesses to infrequently updated

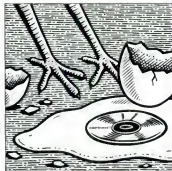


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■ STEPHEN MANES

information: an airline might put its schedules on CD-ROMs at its reservation desks. Telemarketers could use CD-ROM phone directories integrated with dialing software; one vendor japed that for a small fee he might be willing to keep my name and number off his disks.

On the other hand, librarians are quick to mention security difficulties. If somebody walks off with the CD-ROM—just the disk, never mind the player—somebody else may be out thousands of dollars. Pricing and royalty headaches have only begun. If you can put a mini-library on a disk, what do you charge for it and how do you decide who gets paid? By the disk space each work occupies? By number of accesses? Metering schemes to track CD-ROM use have already been announced.

Then there's marketing. Grolier's *Academic American Encyclopedia*, the first general-interest software on CD-ROM, has not sold like hotcakes, perhaps because of the prohibitive cost of the player, perhaps because encyclopedias sell to people who can display the deluxe-bound volumes proudly to prove to the neighbors that they are citizens of literacy and intellect even if they don't have another book in the house. Can one point to a little hunk of plastic with equal pride?

CHEAP EGGS Microsoft's new *Bookshelf* includes most of ten reference works on one CD-ROM with software for instant recall. The \$295 list price seems reasonable; the sting is the \$700 extra you have to cough up for the player. Will Microsoft's cheap egg sell a lot of expensive chickens? Probably not until even cheaper eggs are available by the dozen.

And cheaper chickens would certainly help. If CD-ROM players can plummet in price as fast as CD players have, they might have a shot at becoming ubiquitous computer peripherals—if the frenzy of work on read/write substitutes doesn't yield a viable challenger in a hurry. Given all the competition for the entertainment dollar, the whizbang approach seems far chancier; unless software and hardware are dirt cheap, this could well be the videodisc of the nineties.

Still, many of CD-ROM's peripheral advantages remain undiscovered. For example, playing a CD-ROM in a standard

CD player reportedly generates extremely high-level white noise that can almost instantly blow out most loudspeakers. If so, this may be CD-ROM's single greatest boon to mankind—the ability to sabotage

your neighbor's stereo system. For now, my vote for CD-ROM product of the year is the disc disguised as the latest from the heavy-metal group—oh, why spoil the fun? It just might win a Grammy.

Dr. Dr. Zucker 'Cures'

A JOHNNY CARSON RERUN

Sunnyvale, CA June 1987



Just like the reruns of "The Tonight Show," this column contains highlights from recent articles in which I've

introduced our new line of "Cures" for slot phobia, the fear of running out of slot space.

"The First Cure" for slot phobia is a half card primary board with 128K of conventional memory, plus 0.5 or 1 megabyte of expanded memory (EMS) or extended memory for the AT or 286 compatible. This board snaps into another half card, and thus allows you to have all the functions of two long cards in just one slot.

The secondary board of "The First Cure" can be traded-in at any time for credit toward a higher density expansion board in easy-to-swallow and affordable increments of 1, 2, 4, or 8 megs on the secondary board. What I've done is offer users more memory now, plus upward expandability in the future without obsoleting the initial purchase or having to use up valuable slot space.

"The Second Cure" is a half card primary board configured with either one or two serial ports, a parallel port and clock. The primary board, which works in the IBM PC, XT, or AT and compatibles, also has a video port that is activated when a secondary half card is snapped into the primary card.

With "The Second Cure" you get to choose the video you want — monochrome

or color, text or graphics, high resolution or enhanced graphics or some future standard. As with "The First Cure," the secondary board can be traded-in at any time for higher resolution or more color.

The Zuckerboard "Cures" employ a "Zuckerbus" extended off the back-end of the primary card with the help of a unique mechanical system (patent pending) to let you snap a secondary card into the same place as the first card. The Zuckerboard "Cures" truly make long boards of two short boards.

One of the key benefits of the Zuckerboard "Cures" is that they are a way to "soup-up" your computer without having to add expensive accelerator boards, which can also obsolete your investment in software, boards and peripherals.

A better-way to get more out of your computer is to add memory. This means avoiding "memory full" messages on the screen, delays in file sorting, and printing bottlenecks. Zuckerboards are a convenient and inexpensive way to "soup-up" your computer.

Like all Zuckerboards, these products are priced about half the price of more familiar brands. In addition, they are U.S. made and offer unusual quality and reliability, serviced and backed by a two year warranty. With our unique trade-in policy, you don't have to guess now what your future needs will be. The best part . . . these "Cures" start at just \$99.

With your continued support we can conquer the disease of slot phobia, plus other computing ills, such as the high cost of upgrading your personal computer.

Note: Dr. Dr. Zucker (Mait Zuckerman, PhD) is President of ATD Inc. of Sunnyvale, CA, 235 Santa Ana Court, 408-720-1942.

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REVOLUTION OR EVOLUTION?



It took guts for IBM to design a new bus for the Personal System/2. The important question is how it will be perceived 10 years down the road.

As I write this, IBM just introduced its new line of computers, called the Personal System/2. Looking at the new computers objectively, you would have to say the company is crazy. Even though some 200 companies have made millions of dollars by making exact copies of IBM's original PC, IBM itself has essentially thrown out many of the basic elements of that architecture and introduced a completely new computer, one that features new graphics modes, new displays, new disk drives, new card connectors, and eventually a new operating system.

Has the company gone crazy? Or has it, in some rare and brilliant moment of insight, perceived something about personal computers that will bring great new benefits to us?

These questions frame a debate that, unless I miss my guess, will rage on in the personal computer industry for years to come. Being a good pundit, I'll give you the answer now so that you can rest at ease as you try to figure out what all the new stuff means to you.

THE REAL MESSAGE IBM isn't crazy. Indeed, the company, by having the guts to design and introduce a completely new but upwardly compatible architecture for its line of personal computers, has indeed displayed an all-too-rare willingness to step forward and be counted as a serious computer company. (If I display a certain sense of incredulity, forgive me: I really hadn't expected IBM to be so aggressive.)

Consider the real message behind the introduction of the new system bus called

Micro Channel Architecture (a name that is itself an accomplishment of sorts, since I don't think IBM has ever taken the trouble to give its computers' innards a name). Because the Model 30 sports only the 8-bit card connector around which the original PC was designed and because the Micro Channel sports its own new 16-bit card connector, we can presume that IBM will not introduce any more new computers with the 16-bit connector that is featured in the PC AT. That change is a repudiation of the PC AT architecture and a tacit admission that IBM made a mistake in its previous designs. IBM rarely admits that it made a mistake, particularly by abandoning an existing feature of its systems.

But the fact is that IBM made a mistake with the design of its original PC, although it's a mistake that the company can't really be faulted for. The mistake IBM made was to expect too little out of the PC. The machine was designed outside the company's

normal channels as a minor, opportunistic effort to make a few dollars selling a couple of hundred thousand machines in a strange little market called personal computers. By its original lack of vision, the company vastly underestimated the demands that would be made on the architecture of its PC.

Indeed, as it turns out, the company made a second mistake when it based the design of its PC AT on a processor capable of handling multiple, concurrent, true 16-bit operations but stuck with the original architecture of the PC as a platform for the machine. Interestingly, the company must have known that it was doing something wrong, since it admitted during the introduction of the PS/2 computers that it had started designing the new Micro Channel Architecture in 1983, more than a year before introducing the PC AT.

Those two mistakes—underdesigning the PC and then overextending the architecture to accommodate the 80286—left IBM in a situation in the past two years where it could neither deliver truly new functionality nor solve some of the most vexing problems that had cropped up as a result of its stretched-out architecture.

NOT LEFT BEHIND This is an interesting situation for a company like IBM to find itself in. It has a history and a corporate reputation for never leaving its customers behind but always finding a way to bring them improved technology. But with the introduction of the PS/2, it has posed a serious dilemma for its customers, particularly for the large corporate customers that



■ STEWART ALSOP

exist in IBM's heart and soul. It has asked its customers to adopt a new architecture and, in so doing, to turn over their investment in both computers and peripherals. Essentially, by introducing the new PS/2

computers with only 3½-inch disks, only new card connectors, and only new displays, IBM has asked its customers to commit to the new architecture and to begin the process of planning the obsoles-

cence of the old series of computers.

Are the new computers good enough to get customers to do what IBM wants? Right now that's an extremely difficult question for customers to answer, simply because major components announced by IBM won't be delivered for as long as a year and possibly longer.

Right now, the only reason to heavily buy IBM's new computers and incur the pains and travails of supporting two architectures is that the new machines perform better: they're faster, sport better graphics, are easier to install and service, and are more reliable. The real benefits of the new architecture won't emerge until IBM delivers its version of the new operating system and environment, and applications developers begin to deliver programs that

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■ The only reason to heavily buy IBM's new computers and incur the pains of supporting two architectures is that the new machines perform better.

persuade the rest of us that IBM wasn't crazy after all.

Indeed, the ultimate benefits of the new systems won't be apparent until IBM has to upgrade the Personal System/2 line to use amazing new microprocessor technology in, say, Intel's 80586 and 80686 or in new digital signal processing chips or in new, very high capacity disk drives or some other, unknown technology. Then, in 1995 or 1996, I have a feeling that we'll all be thanking our lucky stars that some inspired somebody at IBM had the guts to brave the slings and arrows of pundits and analysts in order to provide a better platform for the future.

Meanwhile, we're all going to wonder from time to time whether IBM went a little crazy in designing its new systems. ☞

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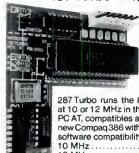
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ersonal computers, like all things man-made, are prey to human error and mechanical failure. One wrong keystroke, and the command to rid your disk of garbage, DEL *.BAK, will wipe away every batch file. Or you

might have watched in dismay as the message "General Failure Drive C:." popped onto your display. Purchasing a backup unit is like purchasing an insurance policy against such occurrences. But like accident insurance, backup devices are one of the few things you purchase in the hope you never have to use them.

In its most basic form, the backup is just a duplicate copy of all your vulnerable data (and, often, programs). By keeping several copies of everything in more than one place, you have a greater chance that one of them will survive should disaster strike your hard disk.

But you can also use some backup systems as data interchange systems. Once you've distilled your important files into a backup, you can send them anywhere, in a single small package, by mail or courier. Choose the right backup system, and you can even interchange data with different

Backup Choices from Tapes to Disks to WORMs

All backup systems are insurance policies against human and mechanical error. And now PC users can choose from a whole spectrum of backup systems. Each offers unique advantages, but a higher price generally means more speed, capacity, and compatibility.

■ BACKUP CHOICES

computer models and even different operating systems, from Macintoshes to mini-computers to mainframes.

If you set up systems for other people, the backup system can make your job a breeze. Once you've obtained the proper software licenses (or only use your own, homegrown programs), you can save a whole hard disk environment on a cartridge, then transfer everything onto another system, setting up the most complex arrangement of files and directories as easily as plugging in the interface card and typing RESTORE.

Not all backup systems offer the same protections or potential, however. Some are faster, some offer more compatibility options, some are cheaper. The first step in finding the right one to suit your own particular needs is to consider all the backup options and technologies that are available to you.

TAPE OR DISK BACKUP? Most backup systems fit into one of two categories—tape or disk. Generally, tapes are sequential systems using a medium similar to the recording tape in ordinary audio cassettes. The tape may or may not be contained inside a cartridge to make loading it easier.

Disks step beyond tape by providing random access to data. It's usually faster to do a file backup on a disk, and it's easier to recover than one on tape. However, the disk drive mechanism is by its nature more complex—and consequently more expensive—than the tape drive and usually does not offer as large a capacity.

Both tapes and cartridge disk systems allow virtually unlimited off-line storage, but disk cartridge capacity tends to cost more per megabyte. Each disk cartridge generally holds less and costs more than a tape cartridge. For instance, while a \$100 disk cartridge might hold 20 megabytes, a \$30 tape can store 60.

Cost is only one reason why tape-based systems are popular for backing up the files on a PC. Decades of use have proven tape to be both a reliable and rugged backup medium.

A variety of tape systems are now available for use with PCs, and more will soon be offered. Among the choices are nine-track open-reel tape, cartridges using 1/2-

inch, 1/4-inch, and 150-mil (thousandths of an inch) tape, and cassettes.

The progenitor of all computer tape technologies is the nine-track open-reel system. Based on reels of tape 1/2 inch wide and up to 3,600 feet long, the first of these systems was developed for mainframe computers in the fifties. No picture of the primordial computer was complete without a reel of tape jerking back and forth inside a closet-size drive.

Open-reel tape and its associated drives have evolved through the years. First able to record 800 bytes of data on every linear inch of tape, the latest of these systems can squeeze 6,250 bytes into the same space.

■ While diskettes are forever linked to one operating system, nine-track tapes know no such bounds.

And the tape drives have shrunk to desktop size.

Despite the evolution of the equipment, it is really remarkable how little 1/2-inch tapes themselves have changed and how standardized they have become. Twenty-year-old tapes originally made for mainframe computers can be read by drives attached to PCs today.

Open-reel tape is, in many ways, the only interchange medium that is standard for all types of computers. The recording format and data structure are essentially the same for open-reel systems no matter who makes them or where they are used.

Open-reel computer tapes use nine tracks arranged laterally across the width of the 1/2-inch tape. Eight of these tracks record data, and one holds a parity-check bit. Each byte of information is written all at once, in parallel across the width of the tape, and successive bytes are written sequentially along the tape. The tape effectively has only one side and is written from one end to the other, then rewound. Flux reversals, the equivalent of data bits, are

spaced anywhere from 800 to 6,250 per inch, with the most common density being 1,600 bits per inch.

The data density, reel size, tape thickness, and a parameter called interrecord gap (the distance between two blocks of data on the tape) all affect how much information will fit a single reel. Capacities of around 60 megabytes are commonplace.

Compared to other technologies, however, open-reel tape is an ungainly choice for backing up PCs. Tape reels can be over 10 inches in diameter and nearly an inch thick (counting their flanges), yet that reel may store no more information than a 2-by-3-inch cartridge. Moreover, most open-reel tape drives themselves dwarf a PC system unit, both in size and price. The cost of an open-reel system designed for connection to a PC starts at \$3,500 and can reach above \$10,000—more expensive than the computer itself.

Just as a battleship can suffer storms on the high seas better than a rowboat, the large size of open-reel tapes earns them an extra measure of security. Data is stored less densely and is less likely to degrade with time or through environmental effects.

But the real value of the nine-track tape systems is in data interchange. Although you can exchange diskettes to share data, nine-track tape moves megabytes as easily as diskettes move kilobytes. And while diskettes are forever linked to one operating system (except through the use of format-conversion software), nine-track tapes know no such bounds. As a result, the big tapes are often used to move databases between systems and distribute information such as mailing lists.

After more than 20 years of dominance in the mainframe world, open-reel tape is slowly being replaced (or augmented) by a new cartridge system developed by IBM. Usually referred to by the model number of the tape drive, 3480, these cartridges are little more than open-reel tapes stuffed into a protective shell.

The tape is still 1/2 inch wide and runs through the drive much like open-reel tapes. The drive mechanism pulls the tape out of the cartridge, winds it onto a tape-up spool, and rewinds it back into the cartridge when it is done.

The difference is more than the conven-

CHOOSING A BACKUP GAME PLAN

In order to make a backup plan that sticks, you'll have to carefully map out a strategy.

No matter what the backup hardware you choose, you still need a backup system. That system requires more than just hardware, or even software, for that matter. To make it work, you must adhere to a strict backup routine even after you make one overall backup of all the files on your hard disk.

The absolute best backup system is one in which you make a duplicate copy of each file as soon as it is made. Finish a worksheet and immediately copy it to your backup medium.

For this kind of backup system, your best choice is a random-access backup system: floppy disks, a duplicate hard disk, a cartridge disk, or a tape system that attempts to emulate a disk device. Random access will speed the backup process so that you can quickly make your copy and get on to something else.

If you don't like the bother of constantly making copies, you may want to investigate Tallgrass Technologies' *BackTrack* software, now supplied with all of the company's backup hardware. *BackTrack* runs in the background and constantly monitors your disk. When it finds a file that has not been backed up, it duplicates it on the backup disk or tape drive.

The second major backup system is one with which the file copies are made

at regular intervals. For instance, every day at an appointed time, you duplicate all the files that have changed that day by copying them onto the backup medium. This sort of routine is the backup choice in systems where data is really important—most mainframes are backed up on such a daily schedule.

Large-capacity media are often best for this kind of backup because the number of files to back up may be great, and you won't want to stick around the whole time shuffling floppy disks in and out of the disk drive.

Traditionally, tape systems have been the choice for these regular backups. While there's no reason that cartridge or duplicate hard disks can't be used, removable-cartridge media (tapes or disks) are usually preferred because they permit you to store several copies of the entire system setup.

Streaming tape is the traditional medium of choice, and, among PC and mini-computer users, the DC600-style cartridge is particularly popular. Of course DC2000, open-reel tapes, or DC1000 cartridges are also suitable (usually in that order). Although the media are somewhat more expensive, cartridge disks can also be used.

For this type of application, image or file-by-file styles are both suitable. When

your hard disk is nearly filled to capacity—with less than 10 to 15 percent of its free bytes free—and you want to back up everything all the time (recovery is faster when all the files are on the same tape), image backups are usually faster. When your disk is far from full or you demand the utmost in file recovery flexibility, file-by-file backups are the better choice.

In either backup mode, the ability to append several backups or files on one previously used tape will save on cartridge costs.

If you plan on overseeing all of your backups as they happen, the fastest backup system is always the more endurable. But if your time is valuable and you don't mind leaving your PC running overnight (and have faith that it will, indeed, continue to run overnight), you can take advantage of the automatic backup programs offered by several manufacturers (including Alloy, Sysgen, and Tallgrass). This software will copy disk files to tape per your instructions but without your intercession at a designated hour, even on a designated day.

The best backup system is the one that enforces the routine that you're most likely to follow. A backup system that does not get used (or used often) is not a backup system at all. —Winn L. Rosch

nience of cartridge loading, however. IBM has doubled the number of tracks (doubling them once or twice more is promised) and increased the data density so that a single cartridge, less than a quarter the volume of an open-reel tape at 4¼ by 4¼ by ¼ inches, can hold hundreds of megabytes. In addition, current implementations write two parallel sets of nine tracks simultaneously, doubling data throughput.

Packing more data on tape has its penalties, however, and with the 3480 system the price you pay is, in fact, the price. Cur-

rently tape drives are big-ticket (\$20,000-plus) products designed for the mainframe market.

Several companies are working at adapting the 3480-style cartridge into systems that would be practical (and affordable) for PC applications. However, these new 3480-style cartridge systems use different data formats from those of the true IBM 3480 tape drive. They lack the big advantage of open-reel tape: its ability to exchange information with mainframes. Although not currently available as a product

to attach to your PC, prices are expected to be in the \$1,000 to \$2,000 range.

CUTTING THE TAPE Cartridge tapes half the width of the ½ inch that's popular among mainframes have become a top choice for backing up minis and PCs.

The first ¼-inch cartridges to gain any degree of notoriety were the predecessors to today's DC600 cartridge. Originally created by 3M Company as a recording medium for data acquisition applications such as transcribing seismological infor-

■ BACKUP CHOICES

mation in the laboratory, this style of cartridge has evolved to fit the needs of computer backup.

While drives using DC600-style cartridges once operated at speeds of a few inches per second, had only a couple of tracks, and could pack only a few megabytes of data per tape, today's machines stream tape at 90 inches per second and can cram 60 or 120 megabytes onto nine tracks on the 600 feet of oxide-coated film in each cartridge. Standards for 300- and 600-megabyte versions have already been developed.

The DC600-style of cartridge is built around a thick, rigid aluminum baseplate that ensures the cartridge will be accurately aligned with the drive mechanism. The tape is driven by a friction band rather than the pressure roller used in audiotape systems. Only the read/write head touches the recording surface of the tape. A clear plastic shell with a hinged door over the head entrance protects the tape.

In most current implementations of DC600-based systems, information is written in nine tracks across the width of the tape. Unlike the parallel recording used for 1/2-inch tape, however, most DC600 systems use serpentine serial recording. Data bits are written sequentially, in one direction, on one track at a time, continuing for the length of the tape. At the end of the tape, the direction of its travel reverses, and recording is continued on the next track until all nine tracks are filled.

One of the biggest advantages of DC600-style cartridge systems is that they are fast. With data transfer rates identical to those of most PC hard disks—5 MHz—the fastest commercial DC600 systems for ATs achieve backup throughput of over 3 megabytes per minute.

A number of companies manufacture DC600-style drives, including Archive, Cipher, Kennedy, and Wangtek. Nearly every system integrator offers a system based on one of these drives. (The list includes Alloy, AST Research, Core International, Emerald Systems, Emulex, Micro Design International, Mountain Computer, Sysgen, Tallgrass Technologies, and Tecmar.) The price of DC600 systems varies with how you buy. Mail-order units are available in the \$600-to-\$800 range; complete name-brand systems may

cost upwards of \$1,500. For reviews of DC600 and other tape backup systems, see "Tape Backup: Measuring Speed and Cost per Megabyte," *PC Magazine*, Volume 5 Number 3.

If DC600 systems have a problem, it is compatibility. Until recently, cartridges written on one manufacturer's DC600-based system could not be read on a system sold by another manufacturer. Although an industry group, the Quarter-Inch Cartridge, or QIC committee, was formed with the aim of standardizing these systems, the group (which consisted primarily of drive manufacturers who do not sell directly to the PC market) concerned itself chiefly with physical standardization. Data formats were left for system integrators to develop—and, in general, each one designed his own.

In general, two DC600-style backup

■ Current systems can pack 40 megabytes on one tiny DC2000 cartridge; 60- and 80-meg drives are under development.

techniques have evolved—image and file-by-file backups—with manufacturers each developing their own standard format for their own tapes.

The image backup is a bit-for-bit copy of the original disk. Bytes are merely read from the disk and copied on tape. Since little processing overhead is involved, these image backups can be fast.

File-by-file backups add structure to the information as it is backed up. Although processing overhead tends to slow file-by-file systems, finding files within the structure (and, hence, individual file restoration) is easier.

These two techniques are tending to merge. File-by-file backups are becoming faster, and smarter restoration software can make sense of the inherent structure of image backups so that individual files can be restored from them.

The trend is toward faster file-by-file backups. Among these systems the compatibility situation is improving, and a standard is emerging: the on-tape data format used by the backup software product, SY-TOS, which is published by Sytron Corporation, Marlboro, Massachusetts. The format gained credibility when IBM adopted the format (and software) for its own line of PC tape cartridge backup systems. Now several manufacturers offer systems using the same format.

SMALL STUFF Another shortcoming of the DC600 cartridge and its drive units is more difficult to surmount: size. DC600 cartridges are almost the size of a paperback book, a full 6 by 4 by 3/4 inches. Squeezing a drive to handle those bulky cartridges into a 5 1/4-inch form-factor PC drive bay, which is itself 6 inches wide, is a considerable engineering challenge; fitting a drive for those cartridges into the increasingly popular 3 1/2-inch form factor is impossible.

The DC2000 cartridge represents an attempt to overcome both of those DC600 limitations. Compact, at under 3 1/4 by 2 1/2 by 3/4 inches, the DC2000 holds 205 feet of 1/4-inch-wide tape.

Current systems can pack 40 megabytes on one of these tiny cartridges; 60- and even 80-megabyte drives are under development. The large capacities are achieved by shoe-horning 20 to 24 serial data tracks across the tape width, using a servo-tracking mechanism to ensure reliable writes and reads.

Two new standards for DC2000 systems adopted by the QIC committee have already become popular: QIC-40 and QIC-100. The former uses a conventional floppy disk controller card as an interface to the tape drive. Although limited to floppy disk transfer speeds, such systems can deliver adequate throughput when properly designed. Because QIC-100 systems use their own dedicated interfaces, they are faster. Of course, they tend to be more expensive (by about \$100 or so) because of the cost of the extra controller.

Because the standards are relatively new, a number of existing DC2000 systems follow neither standard. So-called "floppy tape" systems operate the tape drive as if it were an ordinary DOS disk.

BACKING UP WITH YOUR VCR

Believe it or not, videocassettes are high-capacity storage media. And a clever system for Alpha Microsystems allows you to exploit their capabilities.

Of all media that you can record on directly, videocassettes currently have the greatest capacity. A single tape might hold the equivalent of gigabytes of digital data.

That capacity might make the VCR an intriguing backup device. However, VCRs and computers don't get along well. VCRs are designed to handle analog information, and computer data is in digital form.

By the clever expedient of converting your PC's data into an analog equivalent, Alpha Microsystems has made a VCR-based computer backup system, Videotrax, that offers the lowest possible media cost per megabyte of data storage.

In the Videotrax backup system, a single expansion card in the host computer converts hard disk or other system data into NTSC (National Television Standards Committee) video signals, which can then be backed up and stored on a conventional VHS or Betamax machine.

The Videotrax system combines Alpha Micro's proprietary digital-to-video conversion board (also available separately for use with your own VCR) with a

specially modified VHS machine that the PC can control remotely. The host computer can take command of tape travel during the backup, or you can run the system manually.

One problem faced by the Videotrax or any similar system is that videocassettes generally have more dropouts than do certified computer data cartridges. Dropouts, or minute lapses in the magnetic medium, can cause the recorded signal and the data it encodes to disappear.

Alpha Microsystems ensures against dropout-related problems by writing multiple copies of data to tape, a procedure that is successful because it is statistically unlikely that each of the copies will suffer dropout degradation. According to Alpha Microsystems, this error-protection scheme results in the Videotrax system being one of the most secure forms of information storage available.

However, because of the duplication of information, the total capacity of a single 2-hour video tape is limited to about 80 megabytes.

The Videotrax system also ensures

data integrity by playing back the tape signal and analyzing it to detect errors. In effect, you can certify each backup copy as correct before you depend upon it.

This verification process and the duplication of backups to eliminate dropouts slows down the backup process, however. The Videotrax system creeps along at a rate of about 13 megabytes every 10 minutes, substantially slower than today's streaming-tape systems.

One of the prime advantages of the Videotrax system and using conventional consumer-quality components for data storage is cost. Both the equipment and supplies for video recording are mass produced and readily available at low prices—as low as \$5 for 80 megabytes. Streaming-tape data cartridges cost about five times more.

The hardware price of videotape backup can be lower, too, because you can make use of the video recording hardware that you already own. If you have a VCR, the only hardware you'll need is the Alpha Micro data-to-video conversion board, currently \$595.

—Winn L. Rosch

Tape, however, makes a poor random-access medium. Consequently, these systems are unavoidably slow.

Even the new DC2000 systems are not perfect, however. Most current implementations require you to format the cartridges before use, which can take 40 minutes per tape, and they can also be painfully slow to use (see sidebar "Backing Up After Disaster Strikes").

QIC-40, QIC-100, and similar DC2000 systems currently are priced from \$600 to \$1,100, depending on factors such as internal or external installation. They have not yet invaded the mail-order marketplace in force. For reviews of these systems, see "DC2000 Systems: Pocket-Size Backups" in this issue.

Slightly out of the mainstream are several other tape formats. DC1000 cartridges, about the same size as DC2000s, use 150-mil-wide tape and hold 10 to 20 megabytes. Although slow, they have gained some popularity because of the low price of the associated drives, particularly the products of the dominant DC1000 drive manufacturer, Irwin Magnetics. In fact, when interfaced through a floppy disk controller, DC1000 systems are among the least expensive tape systems available for PC backups, at times offered for as low as \$300 to \$400.

Spooled tape systems, primarily offered by Interdyne Company, Milpitas, California, are an unusual cross between ¼-inch cartridges and open-reel tape. Us-

ing techniques similar to that of IBM's 3480 tape drives, the plastic-cased spool of ¼-inch tape is put in the drive, which automatically threads it onto an integral take-up spool. Although these systems are slow because they rely on floppy disk controllers, the arrival of a new generation of drives with much higher speed potentials is promised soon.

Computer data cassettes have matured from an ungainly youth as a slow-medium-speed, audio-technology-based system for sequentially storing the outpourings of home computers to high-speed competitors to more exotic cartridge systems. Using special high-grade computer cassettes and drives, the new systems can pack up to 60 megabytes on one tape at rates compa-

■ BACKUP CHOICES

able to DC600 cartridge technology. Although cassettes are not quite as compact as DC2000 cartridges, they are a familiar package that holds promise as a strong backup alternative.

Cassette-based systems are priced competitively with DC600-style systems through system integrators but may be sold as much as \$200 less than the larger drives through the mail order channel.

TANGENTIAL TRAVELER Disk media store and restore files faster than do tape media because they have read/write heads that can move to any place on the disk almost instantly. Moreover, because disk backup systems are so similar to the disk systems used for primary storage in personal computers, they can often serve as both on-line storage and backup systems.

Redundancy ranks as the most straightforward disk backup method: just keep two disks spinning with the same files written on each. Odds are that one will survive the erroneous erasure or simple head crash.

Double-disk systems can also be quite inexpensive. Because a second, backup drive needs neither high performance nor an additional controller (most hard disk controllers take care of two different disk drives), adding an extra 20-megabyte hard disk to your system can cost as little as \$300 to \$400.

Although effective in some situations, the double-disk technique affords no protection against such disasters as fires, nor does it give the convenience and security of removable media.

But you can overcome these limitations if your second disk is housed in a removable cartridge. Several such systems are available, including those offered by Amcodyne, IDEAssociates, and Sysgen. (For reviews of these systems, see "Drawing a Bead on Bernoulli," *PC Magazine*, Volume 6 Number 1.)

Although faster than most other backup systems, such removable cartridge hard disk systems are, in general, slower than conventional hard disks. Cartridge capacity and consequently the amount of on-line data is also more limited than that available with conventional hard disks because most disk cartridges contain only a single plat-

ter. Most nonremovable hard disk systems use multiple platters.

A number of removable cartridge disk systems are based on flexible rather than rigid media in the hope of increasing ruggedness and reliability. The most expensive of these flexible media systems—for instance, Iomega Corp.'s Bernoulli Boxes and OEM products built around the same drives—offer performance comparable to better hard disks and a 20-megabyte capacity per cartridge. Prices start at \$1,795. For reviews of the Bernoulli Box, see "Half-Height Alternatives: Cartridge Systems from Iomega and Kodak," *PC Magazine*, Volume 6 Number 11; "Iomega Doubles the Data Storage on Bernoulli Box," Volume 5 Number 6; and "The Bernoulli Solution," Volume 3 Number 18.

Kodak's newly released 12-megabyte (unformatted capacity) cartridge subsystem, which uses the more conventional floppy disk technology, is somewhat slower—equivalent to the slowest ordinary hard disks—and holds only half as much information per cartridge. It's also less expensive, at about \$1,095. (See the comparison of the Bernoulli Boxes and Kodak's system mentioned earlier in Volume 6 Number 11.)

All large-capacity magnetic disk cartridge systems suffer from the same standardization problems endemic to DC600 tape cartridge systems. You cannot exchange information on disk cartridges between different manufacturers' systems. Even IDEAssociates and Sysgen systems, which use physically identical cartridges, are incompatible.

Another new backup system, the optical cartridge or WORM (Write Once, Read Many) drive, gives greater cartridge capacity—hundreds of megabytes—and the security of unalterable records. Although they are true random-access devices, optical disks suffer a speed disadvantage when compared to magnetic disks and often take ten times longer to find a random data byte. However, optical systems can store information more densely than any other technology. (For reviews of seven such products, see "WORMs for Mass Storage" in this issue. You'll also find a description of optical storage technology in "Optical Overview: What's Coming in CD-ROMs and WORMs" in

PC Magazine, Volume 5 Number 17.)

Floppy disks often rate at the bottom of the list of backup choices, but are, nonetheless, a viable alternative, particularly when your equipment budget is tight. They are the most affordable backup systems available simply because every PC already has a floppy disk drive of one sort or another.

Although scoffed at by equipment snobs, floppies (and especially high-density, 1.2-megabyte diskettes) can back up files faster than some of the more exotic streaming-tape technologies when you use a high-performance backup program (see sidebar, "Choosing a Backup Game Plan"). And of course, diskettes also remain the preferred file interchange medium for PCs. If you work on only a few short files at a time, your floppy disk drive may be the only backup system you need.

THE WINNING SYSTEM No one backup system rates as best for everyone. Each has its own combination of features that recommends it for host PC environments. For most people, however, the most important factor in their backup decision is cost. In general, more buys more—speed, capacity, and compatibility.

The most-expensive systems (as mentioned earlier, \$3,500 to \$10,000) for PCs today are those that use nine-track open-reel tapes. They earn their keep by giving your data the utmost security as well as providing a portal through which you can access and exchange data with other computer systems.

Next in the price spectrum are the various cartridge disk systems. For their somewhat steep prices (which seem particularly high when compared to conventional hard disks), you get random-access speed and convenience, the ability to serve as primary mass storage, and unlimited off-line capacity.

Of the available formats of cartridge tape, the DC600 is the fastest and most expensive system. While some DC2000 systems with dedicated controllers can rival the speeds of larger cartridges at less cost, those that operate through floppy disk controllers (and are consequently slower) are the least expensive.

Of today's first-generation DC2000 implementations, however, only a few deliv-

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BACKING UP AFTER DISASTER STRIKES

Can a DC2000 tape backup unit help you recover lost data once the worst has occurred?

They say that the game's not over till it's over. But at what point must you admit defeat after a hard disk failure?

We wondered if, perhaps, a tape backup system could come to the rescue after the worst had occurred. To test whether the DC2000 tape drives had the ability to make order out of a crash, we played our worst tricks on the normal DOS directory and file structure. We converted subdirectories into files, corrupted good clusters into bad, and even cross-linked files. Then we set out to see what help a DC2000 backup system could be in putting things right.

The results were predictable. A tape drive helped us save what we had left but proved unable to dredge up dead files and bring them back to life.

In file-by-file backup mode, the DC2000 systems look at the disks in the same way as does DOS. As a result, our directory-turned-file was saved as an ordinary file with zero length. All of the files listed in it were ignored and not backed up. Cross-linked files were saved all crossed up. Bad clusters in the middle of files truncated transfers.

File-by-file restores from image backups gave the same results as making a file-by-file backup. In the DC2000 systems supporting image restorations, some differences resulted. Every active cluster was preserved, and restoring the image gave much the same mess with which we began.

One dreadful exception: Because the advanced image-backup systems speed moving data to tape by dealing only with active disk clusters, the information from erased files was not preserved. As a result, once a disk environment was restored as an image, use of the so-called unerasing utilities was effectively precluded.

Obviously, making a backup is not going to glue a bad disk back together again. But it can help you save what you can as you try to reconstruct your system.

When a disk problem occurs and you don't have a recent backup, the first thing to do is save what you can. Blow the dust off your backup system and make a tape before things get even worse. Make both an image and a file-by-file backup if your system supports both.

(If the disaster results in your hard disk not being recognized by your system, you've no hope of getting anything onto a backup tape. Chalk up your frustration as an educational experience.)

Only after you have most of your work safely in the can should you confront the corruption problem head-on. Do what you can to fix your disk. Use CHKDSK with the /F option or a byte-level editor to sort through cross-linked files. Unerase what you can with your favorite utilities. Fix and rebuild your disk and its directories. Then back up again—but don't erase the first backup. Maybe after your disk editing you'll have something new that you've saved from oblivion. Maybe not.

Only after you've made at least two copies of your damaged disk, do the drastic stuff: reformat if you must. You can restore what you've saved at your leisure. You might not have everything, but you may have most of the contents of your old disk structure. And you'll have at least one nearly complete backup to fall back upon should disaster strike twice. —Winn L. Rosch

er performance that may be acceptable to the anxious AT user. Some floppy-disk-based backup systems actually operate faster than the DC2000 drives that are on the market today.

In removable-media systems, the price of tapes or disks can be a major factor in overall cost. As an example, you may be able to buy an entire tape drive for the price of a couple of Bernoulli cartridges; for instance, a single 20-megabyte 5¼-inch cartridge costs \$140.

A good rule of thumb is to have sufficient media capacity to hold a minimum of three complete backups. For greater peace of mind or more elaborate backup rituals—such as keeping a separate backup for each day of the week—your media needs increase. Most people actively use be-

tween six and ten tapes in their regular backup routine.

You should also figure in the cost of periodically replacing any media that can wear out. All tape media and all disks except for cartridge hard disks will eventually wear out.

The exact amount of life to expect from a particular medium depends on your own personal paranoia. According to one major media manufacturer, DEI, DC600-style cartridges, which cost about \$35, should last from 5,000 to 6,000 passes across the read/write head. Cautious mainframe managers may routinely replace open-reel tapes after they've been used as few as 50 times. A good compromise, according to DEI, would be annual replacement of your backup tapes.

When you look beyond backing up, other considerations can overrule the price differences between systems. For instance, when you absolutely need access to mainframe tapes or want to interchange information, you'll have to bite the bullet and budget for an open-reel tape drive.

The best backup system is the one that you're most likely to use—and use routinely. No matter how good or expensive it may be, a backup system is worthless if you never bother to put it to work. The backup system that's easiest and most convenient to operate is the one least likely to be ignored—and the one most likely to be of help when disaster strikes. □

Winn L. Rosch is a contributing editor of PC Magazine.

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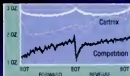
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| Type or Drive Class | Capacity in Megabytes | | |
|---------------------|-----------------------|-----|-----|
| Retriever/120™ | 168 | 200 | 224 |
| QIC-150 | 150 | 180 | 200 |
| QIC-120 | 125 | 150 | 166 |
| QIC-24 | 60 | 72 | 80 |
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DC2000 Systems: Pocket-Size Backup

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C2000 cartridges, which look like shrunken versions of 3M's immensely successful DC600-style tape cartridges, let you tote 40 megabytes of formatted data in your shirt

pocket. The seven drives reviewed here from Advanced Digital Information Corp. (ADIC), Alloy Computer Products Inc., Archive Corp., Irwin Magnetic Systems Inc., Micro Design International Inc., Mountain Computers Inc., and Tallgrass Technologies Corp. are the first to use the DC2000 cartridges and may indeed be the first of the next generation of PC backup systems.

The products are as varied as the label "cartridge tape backup system" allows them to be. They use various standards, formats, and even packaging schemes. Yet any of them can make backing up your hard disk a simple—if time-consuming—process.

The key element to all of these cartridge tape backup systems is the new DC2000 data cartridge.

The seven DC2000-based tape drives reviewed here represent the first of a new generation of PC backup systems. But the drives' speeds could slow their acceptance in the marketplace.

POCKET-SIZE BACKUP

The DC2000 cartridge shines as a marvel of miniaturization. Compared with the 6- by 4- by $\frac{3}{8}$ -inch DC600 cartridge, which is the size of a paperback book, the DC2000's outer shell is just under $\frac{3}{4}$ by $\frac{2}{5}$ by $\frac{1}{8}$ inches, which makes it about the size of a cassette tape from your favorite recording star. While tape capacity was trimmed—from 600 to 205 feet—data capacity has suffered only slightly. The tape width is the same, $\frac{1}{4}$ inch, for both.

When the first DC2000 systems were introduced, the diminutive cartridges could hold 40 megabytes, versus 60 for the bigger DC600. Of course, technology doesn't stand still and standards are being hammered out for 300 and 600 megabytes on the larger tapes, 100 and 200 megabytes on the DC2000's.

The similarity between the DC600 and DC2000 cartridges hardly is an accident. Both are based on the same design principles and built from a solid aluminum base-plate and clear plastic protective shell. Inside, the same patented mechanism shuttles the tape between two hubs.

An elastic friction band wraps around the tape spools and gently pulls the medium along. Although a capstan system, like that used on audio- and videotape recorders, ushers the drive band along, no pinch roller ever touches the tape. In fact, the only part of the mechanism that actually touches the magnetic surface of the tape is the read/write head.

Currently, three companies hold licenses to use this technology and make cartridges: 3M, which originally developed the system; Data Electronics Inc. (DEI) and Hewlett-Packard Co., which does not currently sell cartridges in the retail market.

DOUBLE STANDARD DC2000 cartridges differ from the DC600 style in their degree of standardization. The recording standards used by DC600-based systems evolved over more than a decade. The resulting confusion eventually led to the formation of the Quarter-Inch Compatibility (QIC) committee, comprised of tape drive manufacturers and other interested parties, to hammer out standards for drive manufacturers.

The QIC committee soon developed two standards for systems that are based on



In addition to DC2000 systems, the options for backing up your data include (1) Iomega's $\frac{5}{8}$ -inch Bernoulli cartridge, (2) Kodak's 12-megabyte cartridge, (3) a Dysan $\frac{5}{8}$ -inch removable Winchester cartridge, (4) Amcodyne's removable cartridge, (5) DEI's 3480 cartridge, (6) a nine-track open-reel tape, (7) Interdyne's spooled tape cartridge, (8 and 9) 3M's DC2000 and DC1000 cartridges, (10) IDE and System's removable cartridge, (11) DEI's DC600 cartridge.

the DC2000 cartridge: QIC-40 and QIC-100. Additional standards, for advanced high-capacity systems, are currently in the works.

QIC-40 is aimed at the PC market. It has a tape format patterned closely after that used by MS-DOS disks, although recently certain aspects (the time and date format, for instance) have been modified to better match UNIX systems as well.

Under the QIC-40 standard, 20 tracks are arrayed across the width of the tape,

each holding roughly 2 megabytes of data. Each track is broken into 68 segments of 29 sectors containing 1,024 bytes each. Each tape has the equivalent of a file allocation table that lists bad sectors contained on the tape so that no bytes are risked on bad or marginal media.

Data bits are written using the modified frequency modulation recording method (sometimes called "double-density") at a density of 10,000 bits per inch.

Tape drives under the QIC-40 standard



Formatting DC2000 Tapes

Most of the DC2000 systems reviewed here use PC/T tape format. This scheme stores data in 5K allocation units consisting of two 4K data blocks and an added parity block. The parity block is created from an "exclusive or" Boolean comparison (XOR) of the two 4K data blocks done by the backup software. Should either of the two data blocks become corrupted, the remaining block can be compared with the parity block and the information in the corrupted block can be regenerated.

Speed gap



run at either 25 or 50 inches per second when writing data, depending on the data transfer rate of the unit's floppy disk controller. These data transfer rates are comparable to normal double-density floppy disk drives (XT-style), which operate with a data transfer rate of 250K bits per second, and AT-style high-density (1.2-megabyte) controllers, which operate at 500K bits per second.

Under the QIC-40 standard, one-third of the possible 60-megabyte capacity of the DC2000 tape is devoted to format structure and error correction, using both cyclical redundancy checking and a Reed Solomon code (an efficient error-correction algorithm that's also used in such areas as interplanetary communications). As a result, an error rate of $1 \text{ in } 10^{14}$ is claimed for QIC-40, a rate that predicts fewer errors than that achieved with most disk drives.

NO CIGAR The QIC-40 standard promises that you will be able to interface DC2000 tapes between tape drives of different manufacturers. And in fact, QIC-40 offers a level of compatibility comparable to that enjoyed by nine-track open-reel tape systems, usually regarded as the best of any medium.

However, the QIC-40 standard does not specify the exact arrangement of the tape file structure. Because there's no compatibility of file structure, you can read all the bytes off a tape on any system, but their structure will be lost. As a result, you can interchange tapes between differ-

ent drives, but you might not be able to decipher the results.

Although the QIC-40 standard for DC2000 cartridges is stricter than those applied to DC600 tapes, the result is the same. Cartridges remain captive to the manufacturer and model of the system making them. What's needed for complete interchangeability of tapes is standard for file structure, which can be achieved only through the co-operative development of software or complete control of the software industry (à la MS-DOS).

QIC-100 is a looser standard than QIC-40 because it allows each manufacturer to develop its own controller. Hence QIC-100 is faster because it is not limited to the floppy disk interface speeds, as is QIC-40. On the other hand, the need for a separate controller makes a complete QIC-100 system more expensive.

QIC-100 puts 12 or 24 tracks across the tape at a recording density of 12,000 flux reversals per inch. The actual data density is somewhat less because the specification calls for Group-Coded Recording, which uses five flux reversals to encode each 4-bit nibble of data. (Although it sounds somewhat contrary to logic, GCR actually allows information to be packed tighter on a given recording medium.)

As with QIC-40, you must format the tapes used by QIC-100 before use. Every block of data (the manufacturer defines the length of data blocks) features a special Cyclic Redundancy Code block to detect data errors. In addition, the standard allows the use of error correction.

NOT SO SPEEDY As clever as these systems are, both have limitations. Some are related to the drive mechanism; others are software difficulties. All, however, result in longer waits than most AT users may be accustomed to.

For instance, most DC2000 drives use single-channel heads to squeeze 20 or 24 tracks across the 1/4-inch tape width. A servomechanism moves the head up and down, tangential to the tape, to the proper position for each track. The head servomechanism senses the edge of the tape to index the head location exactly and ensure proper tracking.

Before a backup can begin, most drives look for the top edge of the tape, then back down a measured distance to ensure that the head will be located at the first track, which, according to the standard, is near the middle of the tape. This indexing process can take dozens of seconds.

At first, QIC-40's use of standard floppy disk controllers seems like a winning combination. Since no special interface hardware is necessary, costs are cut and installation is easier because all you need do is to plug two cables (power and data/control) into the drive and then slide the unit into place.

However, you're stuck with the floppy disk controller's relatively slow data transfer rate. The older DC600-style systems had no such speed limits and often transferred bytes ten times faster at hard disk speeds, 5 megabits per second.

Both QIC-40 and QIC-100 require you to format tapes before use. However, by

POCKET-SIZE BACKUP

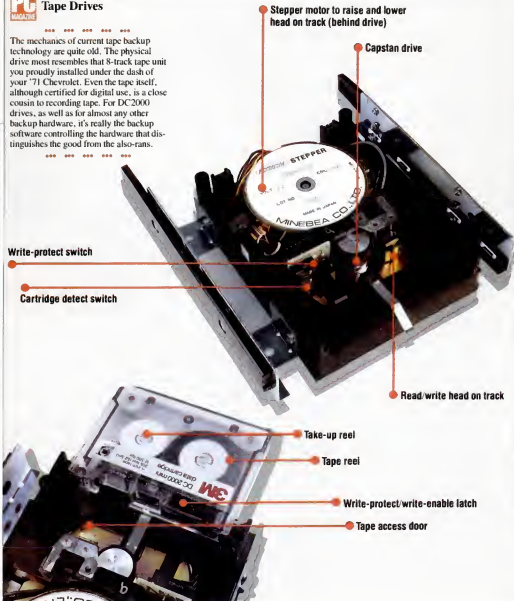


Inside DC2000 Tape Drives

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The mechanics of current tape backup technology are quite old. The physical tape drive most resembles that 8-track tape unit you proudly installed under the dash of your '71 Chevrolet. Even the tape itself, although certified for digital use, is a close cousin to recording tape. For DC2000 drives, as well as for almost any other backup hardware, it's really the backup software controlling the hardware that distinguishes the good from the also-rans.

... ..



the manufacturers' own accounts, formatting the entire 40-megabyte tape capacity takes half an hour. Even that figure ignores such collateral matters as winding and re-winding the tape and indexing the read/write head.

In my trials, the time from the key-stroke that invokes the format command until control returns to the host computer often measures more than 40 minutes. And during that time you can use your computer for nothing else.

You can buy preformatted tapes—for a price ranging from an additional \$1 to \$5. But judging from the underwhelming acceptance of preformatted disks (think of DEC's Rainbow 100, for instance), I don't think many will choose this option.

The preformatted approach does offer some benefits. During the formatting process, bad sectors can be reserved. The format also allows individual tape sectors to be accessed randomly. Consequently, some of the cartridge systems examined

here attempt to mimic floppy disks.

Additionally, preformatting adds place markers to the tape that make it easy to append files to a partially used tape. That's one reason why many DC600-based systems will not allow you to append to a tape, yet all of these DC2000 systems do.

GOOD ENOUGH The result is that most of this current crop of DC2000 systems take up one floppy disk slot and substitute a frustratingly slow single-purpose backup system that uses small cartridges. With most of these systems, backing up a full 32-megabyte DOS partition will take 20 to 30 minutes or more.

Nonetheless, these systems may be good enough. All make workable backup systems despite their slowness. Irwin Magnetics, for instance, has been extremely successful in selling its proprietary DC1000-based systems that impose many of the same speed limits.

In fact, there are a number of legitimate

reasons for investing in one of these systems. Any backup system is better than none. If you've never had a fast backup system, the slower throughput may not be apparent or bothersome. And there are effective strategies for avoiding the wait. For example, you can use a time-initiated backup program that will take care of everything at night or during your lunch break; many of these systems include such software. There is hope, too, that as these systems become more developed, they're likely to get better and faster.

As we tested these systems, it became apparent that many of the speed problems that we encountered were software based: they have to be, when two systems operating at an identical data transfer rate differ by a factor of two for the backup speed on the same task. Moreover, even at floppy disk rates, these systems theoretically should be able to transfer more than 3 megabytes per minute—a rate several systems claim and none deliver.



DC2000 Systems: Summary of Features

(Products listed in ascending price order)

| | MDI External MT-40P AT Micro Design International Inc. | Archive XL 5540 Archive Corp. | Alloy APT-40 Model 500 Alloy Computer Products Inc. | Irwin 14S and Irwin 44S Irwin Magnetics Systems Inc. | Mountain TD4440 Mountain Computer Inc. | TG-1040e HS Talgrass Technologies Corp. | ADIC TD-440 Advanced Digital Information Corp. |
|--|---|--------------------------------------|--|--|---|--|--|
| List price | \$595 (internal unit) \$695 (external unit) | \$649 (for XT) \$699 (for AT) | \$695 | \$795 (internal Irwin 14S) \$895 (external Irwin 44S) | \$795 | \$795 (internal unit) \$1,095 (external unit) | \$1,390 (internal unit) \$1,590 (external unit) |
| Price per megabyte | \$14.88 (internal) \$17.38 (external) | \$16.23 (for XT) \$17.48 (for AT) | \$17.38 | \$19.88 (Irwin 14S) \$22.38 (Irwin 44S) | \$19.88 | \$19.88 (internal) \$27.38 (external) | \$43.44 (internal) \$49.69 (external) |
| Capacity (megabytes), formatted | 40 | 40 | 40 | 40 | 40 | 40 | 32 |
| Internal or external | Both | Internal | Internal | Both | Internal | Both | Both |
| Tape drive interface | Floppy disk | Floppy disk | Floppy disk | Floppy disk | Floppy disk | Proprietary | SCSI |
| Size of unit (HWD in inches) | 3 × 8½ × 9 | 1½ × 5½ × 7 | 1½ × 5½ × 7 | 2 × 4½ × 7½ | 1½ × 5½ × 8 | 7 × 4 × 14½ | 3 × 6½ × 11 |
| System specification | Proprietary | QIC-40 | Proprietary | Proprietary | QIC-40 | QIC-100 | QIC-100 |
| File-by-file backup | ● | ● | ● | ● | ● | ● | ● |
| Image backup | ○ | ○ | ○ | ○ | ● | ● | ○ |
| Floppy emulation | ○ | ○ | ○ | ○ | ○ | ○ | ● |
| User interface | Menu | Menu | Menu | Menu | Menu/command | Menu | DOS |
| Automatic backup | ● | ○ | ● | ● | ● | ● | ○ |
| Batch mode | ● | ● | ● | ● | ● | ● | ● |

— Indicates Editor's Choice ● = Yes ○ = No

■ POCKET-SIZE BACKUP

Improved software might push performance times of QIC-40 systems down near that of high-speed floppy disk backup systems—limited, however, by the overhead required for error-correction codes and the necessities of the drive mechanism. QIC-100 systems should be able to fly as fast as DC600-based backup units.

But for now, I suggest that those on tight budgets ignore the high tech and invest in a fast floppy disk backup program. If you can afford it, you'll be better off (and probably much happier) spending a few hundred dollars more on a DC600 system. To help you judge for yourselves, we review seven products, which are listed in alphabetical order by manufacturer.

ADVANCED DIGITAL INFORMATION CORP.

ADIC TD-440

The sturdy ADIC TD-440 from Advanced Digital Information Corp. is an external tape system that thinks it's a disk drive. Once installed, it reacts to most DOS commands as any disk would, but more slowly. That disk similarity rates as the TD-440's strongest and weakest suit.

Its resemblance to a disk makes the TD-440 familiar to the user and to DOS. You use DOS commands like COPY, MKDIR, ERASE, and CHKDSK to run the little tape drive. As a result, you need no special software for your daily backup.

ADIC doesn't give you much software, either. The TD-440 system comes with a device driver, a formatting program (the drive is incompatible with DOS FORMAT), testing utilities, plus the SARCHIVE file-by-file backup and SRESTORE restoration utilities. The last two are not documented in the accompanying manual.

The 3- by 6½- by 11-inch (HWD) all-metal box has a gray-beige pebble finish and no controls other than those on the drive and the power switch on the rear panel. A red LED on the front panel indicates that the drive is active.

The system connects to the host PC through a SCSI interface using an 8-bit interface expansion board that's 5 inches long. ADIC supplies a full meter of cable. The SCSI interface hints that this same unit truly appears in other systems—maybe even



~~~~~  
The ADIC TD-440 is an external 3- by 6½- by 11-inch drive that connects to the host PC through an SCSI interface using an 8-bit interface expansion board. The unit thinks it's a disk drive—it uses familiar DOS commands like COPY and CHKDSK and needs no special software for daily backup.  
~~~~~

the Macintosh. A power cable is supplied for plugging the drive into a wall outlet.

You configure your system by adding the ADIC device driver to your CON-

FIG.SYS file. During the process, your only major choice is whether the tape appears as one big 32-megabyte drive or two individual 17.8-megabyte units. The latter is the default.

Before use, you format the tapes per the QIC-100 standard. Although the documentation claims the process requires 48 minutes, it actually finishes in 41. ADIC also supplies preformatted cartridges.

Performance is not a virtue of the TD-440. The PC Labs BIGFILE test, which copies a 10-million-byte file using DOS, required 24 minutes, versus about 2 minutes to move the same file between hard disks. Using the SARCHIVE program supplied by ADIC, the 10-million-byte backup required just over 13 minutes. Restoring the same file took 35.

Backing up the 1,586-subdirectory environment in the PC Labs SCATTER test proved frustrating. The TD-440 does not handle multiple subdirectories well. Creating one subdirectory seven levels down



FACT FILE

ADIC TD-440

Advanced Digital Information Corp.

14737 NE 87th

P.O. Box 2996

Redmond, WA 98052

(800) 336-1233

(206) 881-8004

List Price: \$1,590 (external unit); \$1,390

(internal unit).

Requires: 128K RAM; DOS 2.0 or later.

In Short: An internal tape backup system based on the QIC-100 that uses an SCSI interface and software to emulate a random access disk drive, yielding slow operation for conventional backup.

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■ POCKET-SIZE BACKUP

and writing one 2K file inside it required almost 5 minutes of shutting the tape back and forth. SARCHIVE records subdirectories faster, but in manual mode it requires confirmation before it backs up each subdirectory. I did not test it fully because I had little desire to sit in front of the test AT and mash the Y key 1,586 times, doubtless over a period of days.

ADIC has one further inconvenience. Before you can remove a cartridge from the drive, you must run a special program to flush the buffers used by the system and thereby guarantee that everything you sent to tape actually gets there. Presumably you'll also want to run this program before shutting down your PC.

If you're looking for disklike performance, look elsewhere. If familiarity breeds content, a dedicated DOS-lover might find affection for the TD-440.

ALLOY COMPUTER PRODUCTS INC.

Alloy APT-40 Model 500

Although based on a floppy disk interface, the Alloy APT-40 Model 500 is not a QIC-40 system. Instead, it relies on a data format that Alloy has designed to facilitate using tape as an exchange medium and has used successfully for a number of years in larger cartridge tape systems. In fact, the TIP in the name of the Alloy software, *TIP-40*, stands for Tape Interchange Program.

The APT-40 Model 500 drive itself is a compact unit; the controller and mechanicals fit easily into a 3½-inch form factor package. To spin its capstan, the drive uses a belt-driven servo drive motor with an optical sensor. The head scans across tape tracks using a thin helical screw drive. No eject button is provided or required; you simply slide tapes in and pull them out when you are done.

As with all of the systems reviewed here, Alloy requires you to format tapes before use. Up to 20 tracks can be formatted to yield up to 40 megabytes of on-tape storage. Or you can format even numbers of tracks to achieve smaller capacities but save time. Alloy claims that a full format takes 30 minutes; however, the process—from the time of last required key-stroke to when you regain control of the

 **FACT FILE**

Alloy APT-40 Model 500
Alloy Computer Products Inc.
100 Pennsylvania Ave.
Framingham, MA 01701
(617) 875-6100
List Price: \$695

Requires: 128K RAM; 256K RAM recommended; DOS 2.0 or later; AT floppy disk controller.

In Short: An internal file-by-file backup system, based on the DC2000 cartridge that uses your computer's existing floppy disk controller and fits a half-height drive bay.

CIRCLE 884 ON READER SERVICE CARD

system—actually requires about 35.

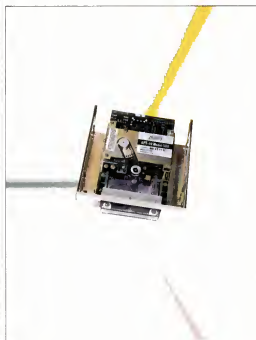
According to Alloy, its drive is currently certified only for DEI tapes. Although cartridges from 3M are not certified, they worked fine during our testing and resulted in no errors.

You install the APT-40 Model 500


drive just as you would a floppy disk: by plugging it into the B: drive connector and sliding it into a vacant half-height drive bay. The small drive adapts to the 5¼-inch form factor by using metal brackets on each side and includes standard AT mounting rails. The drive reads and writes tape at 50 inches per second at the AT's 500K-bit-per-second data transfer rate. The Alloy APT-40 Model 250 is similar but slower, designed for the 250K-bit-per-second rate of PCs and XTs.

The Alloy software adaptation is not quite as successful as the drive mechanism. In attempting to work like Alloy's DC600-style backup software, the *TIP-40* version imposes leisurely delays because of the constraints of the drive mechanism. For instance, when you load the program, you'll find yourself waiting for nearly 2 minutes while the tape drive initializes itself and, often, retensions the tape.

Once running, the *TIP-40* program is so easy to use that you won't need its documentation. A single preliminary menu



~~~~~  
*The controller and mechanism of the compact Alloy APT-40 Model 500 fits easily into a 3½-inch form factor package. The system's TIP-40 software uses Alloy's own data format. You install the 1¼- by 5¼- by 7-inch drive by plugging it into the B: drive connector and sliding it into a vacant half-height drive bay.*  
~~~~~



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■ POCKET-SIZE BACKUP

gives you your choice of system activities—backup, restore, and utility functions. Submenus activate the desired operations. *TTP-40* contains only file-by-file functions and has no image mode, but it furnishes all the normal file selection abilities and allows batch processing.

When it comes to putting data to tape, performance is lost to software overhead. At 11 minutes, the backup of a single, 10-million-byte file in the *BIGFILE* test was endurable. But the system took nearly 28 minutes to handle the multiple file-and-subdirectory *SCATTER* test.

Actually, this time is comparable to that demonstrated by Alloy's DC600 system in earlier testing even though DC600s tend to be faster systems, so obviously the speed culprit is the software.

Although slow, the Alloy can be a useful backup system when running *TIPTOK*, a program included with the system that automatically starts backing up at an appointed time.

ARCHIVE CORP. Archive XL 5540

The Archive XL 5540 system is based on a 3½-inch form factor DC2000 drive that fastens easily to a standard AT half-height drive slot with a pair of steel channels and mounting rails. The drive uses a direct-drive capstan motor, a rotary positioner, and large helical screw to raise and lower the read/write head.

A hinged plastic door guards the cartridge slot and pivots upward when you



~~~~~  
The Archive XL 5540 closely follows the QIC-40 standard and operates at a data transfer rate of 500 kilobits per second off a standard AT floppy disk controller. Unlike most DC2000 drives, the 1½-by-5½-by-7-inch XL 5540 swallows a cartridge. You press a button atop the cartridge slot to eject the cartridge.  
~~~~~

slide in a tape. Unlike most other DC2000 style drives, the Archive completely swallows a tape cartridge. Pressing a push button atop the slot ejects the cartridge. To the right of the release button is a red drive activity LED.

The Archive XL 5540 closely follows the QIC-40 standard and operates at a data transfer rate of 500K bits per second off a standard AT floppy disk controller. A similar model, the 5240, is rated at 250K bits per second for XT applications.

Installation is a matter of sliding the drive into the B: drive bay, plugging it into the B: drive connector on your floppy disk data cable, and attaching a power supply cable to the drive. The Archive drive is unusual in that some systems (including mine) will think that it is a malfunctioning floppy disk drive if you leave a cartridge in the drive when you boot up.

The drive is controlled by Archive's *QICstream* backup software. *QICstream* is marked by a very simple menu sys-

tem—just a few lines of text on the screen—that's also amenable to batch file operation.

In some ways the Archive software deserves the attention of other manufacturers. It keeps you posted on all the arcane activities involved in operating the QIC-40 system, to the point of telling you when it is looking for the top edge of the tape. Although such messages don't do anything for system performance, they are reassuring, especially considering the lengthy waits all these DC2000 tape systems engender.

The software appears to be designed to implement a simple backup system, giving you the option of full backups or a backup of changed files only. If you wish, you can also individually select files for backing up, but there is no provision for true image backups.

That said, the Archive system is slow, even compared with other DC2000 systems. Backing up during the 10-million-



FACT FILE

Archive XL 5540

Archive Corp.
1650 Sunflower
Costa Mesa, CA 92626
(714) 641-0279

List Price: \$699 (for XT); \$699 (for AT).

Requires: 256K RAM; DOS 2.0 or later; floppy disk controller.

In Short: An internal file-by-file backup system, based on the QIC-40 standard for the DC2000 cartridge, that operates slowly through your computer's existing floppy disk controller.

CIRCLE 688 ON READER SERVICE CARD

POCKET-SIZE BACKUP

byte BIGFILE test required 11 minutes, 24 seconds. Backing up a 1,578-subdirectory hierarchy (with two 2K files in each sub-directory) during the SCATTER test required 27 minutes, 49 seconds.

The Archive drive is the most sturdily built of all the drives reviewed here. As a complete system, however, it doesn't live up to its potential.

IRWIN MAGNETIC SYSTEMS INC.

Irwin 145 (Internal) Irwin 445 (External)

More PCs depend on tape drives made by Irwin than those of any other manufacturer. Irwin was among the first to acknowledge the need for compact, inexpensive tape backup systems for PCs. And it has built several systems based on the smaller DC1000 and DC2000 cartridges.

The Irwin 145 (Internal) and 445 (External) drives are among the latest. These tape transports are available either unadorned, expanded to fit a half-height, 5¼-inch drive bay (the Irwin 145), or in a minuscule external chassis that's only 2 by 4½ by 7½ inches (the Irwin 445).

These cartridge units share the same technology, interface, and software. As with previous Irwin efforts, these newer units do not follow any committee-endorsed standard. But because of their sheer volume of sales, they may become a standard in themselves.

The Irwin interface is based on the standard floppy disk controller, but the drives



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The Irwin 145 (Internal) and Irwin 445 (External) drives do not use a committee-endorsed standard. The interface is based on a standard floppy disk controller, but the 2-by 4½-by 7½-inch drives do not connect directly to the floppy disk cable; a special interface card intercepts signals from the controller to the floppy disk before sending them along.  
~~~~~

do not connect directly to the floppy disk cable. Instead, a special interface card intercepts the signals from the controller to the floppy disk, plays with them, then sends them on their way again.

The Irwin adapter is an 8-bit-bus short card that slides into the expansion slot next to the native drive controller. The Irwin interface has the ribbon cable that would ordinarily connect floppy disks to their controller. You use a short ribbon cable, which Irwin supplies, to connect the interface to the header on the same controller to which you would normally attach the floppy disk cable.

In addition, for the Irwin 445 external tape drive, you must connect a power cable—like the one you'd normally plug into a tape or disk drive—to the controller card. The 445 does not have an internal power supply but rather draws its current through its direct cable connection to the AT's power supply. This power connection to the interface card eliminates the need to

draw high currents through (and possibly overload) the AT's internal expansion bus.

The Irwin software consists of a substantial set of programs that bear the name *EzTape*. Supplied on two diskettes, *EzTape* is easy to install, handling the entire chore automatically except for a quick switch of the disks.

EzTape is completely file oriented and operates either directly through a menu-driven front end or through batch files. Irwin simplifies its operation by including two ready-made batch files, *BACKALL* and *CHANGED*, that back up either your entire hard disk or just the modified files. You'll need to learn nothing more than these commands for most ordinary backup routines.

Additionally, you can take full manual control and back up and restore individual files through the *EzTape* moving-bar menu system. Or you can build parameter files to automate your personal backup system.

EzTape allows you to include or ex-



FACT FILE

Irwin 145 (Internal)
Irwin 445 (External)
Irwin Magnetic Systems Inc.
2101 Commonwealth Blvd.
Ann Arbor, MI 48105
(800) BACKUP1
(313) 996-3300

List Price: \$795 (internal); \$895 (external).
Requires: DOS 2.0 or later; 256K RAM.
In Short: DC2000-based tape backup system using a proprietary standard operated through your computer's existing floppy disk controller with additional Irwin hardware.

CIRCLE 61 ON READER SERVICE CARD

POCKET-SIZE BACKUP

clude individual files (including hidden and system files) from backup sessions; alternatively, you can key your backups to file attribute bytes or time and date.

Irwin also includes some useful utilities. One of these, TFORMAT, formats tapes (although Irwin supplies preformatted tapes). The process takes just over half an hour. EzStart allows you to set the date and time at which a backup session will automatically start, allowing your system to make backups unattended.

The performance of the Irwin system rates in the middle of the pack when compared with other DC2000 systems, requiring about 9 minutes to back up the single, contiguous 10-million-byte BIGFILE test. It was unable to handle a hierarchy of subdirectories during the SCATTER tests, however, begging off with the error message: "The length of this path exceeds the limit. Files in this directory and it's [sic] subdirectories will not be backed up."

MICRO DESIGN INTERNATIONAL INC. MDI External MT- 40P/AT

Micro Design International is not a tape drive manufacturer but a system integrator that takes components from others and then assembles them into tightly integrated subsystems. Although the MDI External MT-40P/AT is based on an Alloy APT-40 Model 500 cartridge tape drive and Alloy's own TIP-40 software, Micro Design as-



Micro Design International's 3- by 8-1/4- by 9-inch MDI External MT-40P/AT is based on the Alloy APT-40 Model 500 but adds an important benefit: portability. The drive and power supply are packaged in a case with a handle. Since the system is operated by a standard AT floppy controller, it requires no additional interface board.

an important benefit to its backup system: portability.

Micro Design packages the Alloy drive and a small linear-technology power supply together in a black plastic instrument case with a large handle. Hence, you can move it from computer to computer, backing up a whole office-full of data with one small hardware investment.

Because it is operated by a standard AT floppy controller, the External MT-40P/AT requires no additional interface board. It does, however, use some fancy cabling to access the output of the AT's disk controller.

Micro Design supplies a "paddle board" that plugs into the B: drive output of the existing AT floppy disk data cable. To make the connection, you slide a second cable onto the other end of the paddle board and route it to the rear panel of the host computer. You then mount a connector on the far end of the cable onto the outside of the AT chassis with hardware that

Micro Design provides with the system.

You connect another length of cable between the new external floppy disk jack and the rear of the External MT-40P/AT. The cabling system costs \$50 and can be ordered separately so that you can modify several ATs to share one tape drive.

A similar model, the External MT-40P/XT, is available for backing up PCs and XTs. Based on the Alloy APT-40 Model 250 drive, the XT model operates somewhat more slowly due to its 250K-bit-per-second data transfer rate (compared with 500K bits per second for the AT model) but requires no cabling work. It plugs directly into the floppy disk expansion connector on the rear of the XT controller.

The Micro Design software strongly resembles the TIP-40 program that Alloy supplies. Only the full-screen Alloy initial logo display is missing. Consequently, the Micro Design system operates just like the Alloy APT-40 Model 500 and delivers vir-



FACT FILE

MDI External MT-40P/AT
Micro Design International Inc.
6985 University Blvd.
Winter Park, FL 32792
(800) 228-0891
(305) 677-8333

List Price: \$695; \$595 for internal unit; Adapter, \$50.

Requires: 256K RAM; DOS 2.0 or later; floppy disk controller.

In Short: A DC2000 tape backup system in a portable case for shuttling between PCs; based on Alloy hardware and file-by-file software.

CIRCLE 660 ON READER SERVICE CARD

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Steve Gibson, InfoWorld 12/1/86

Raye
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-  IBM

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make great EGA graphic workstations for CAD/CAM. Or choose enhanced EGA™ or GA 786™ graphics from ALR and a variety of sources and get the most advanced resolutions available.

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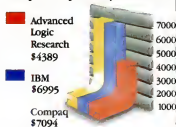


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Read the reviews and compare the 386/2 to the others. Then compare more. If you find more power, flexibility and quality somewhere else, buy somewhere else. You won't find a more competitive price anywhere else.



The ALR 386/2 Model 40 with EGA adapter is similar to the IBM Model 80-041 and Compaq Deskpro 386 Model 40 with EGA adapter. Except for a lower price and twice their standard RAM.

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Performance Specifications

386/2 Model 10

\$1990

- ALR-designed system board
- 16 MHz 80386 processor
- 10 MHz 80287 support
- 1 MB 32-bit RAM, expandable to 2 MB on system board
- 1.2 MB floppy disk drive
- Serial and parallel ports
- 8 expansion slots
- 101-key keyboard

386/2 Model 40

\$3990

- ALR-designed system board
- 16 MHz 80386 processor
- 10 MHz 80287 support
- 2 MB 32-bit RAM
- 40 MB, 30 ms, or less, access time hard disk drive
- EMS and multitasking software
- 1.2 MB floppy disk drive
- Serial and parallel ports
- Desktop or floor mount
- 8 expansion slots
- 101-key keyboard

386/2 Model 80

\$4690

- ALR-designed system board
- 16 MHz 80386 processor
- 10 MHz 80287 support
- 2 MB 32-bit RAM
- 70 MB, 30 ms, or faster, access time hard disk drive
- EMS and multitasking software
- 1.2 MB floppy disk drive
- Serial and parallel ports
- Desktop or floor mount
- 8 expansion slots
- 101-key keyboard

386/2 Model 130

\$7299

- ALR-designed system board
- 16 MHz 80386 processor
- 10 MHz 80287 support
- 2 MB 32-bit RAM
- 150 MB, 30 ms, or faster, access time hard disk drive
- EMS and multitasking software
- 1.2 MB floppy disk drive
- Serial and parallel ports
- 8 expansion slots
- 101-key keyboard

Enhancements

A complete range of enhancements, including 4 MB 32-bit RAM and multifunction products as well as additional I/O options are available. 640 x 480 pixel AV EGA with 16 colors and GA 786 graphics adapters available third quarter.

Monitor not included



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■ POCKET-SIZE BACKUP



Performance Tests: DC2000 Systems

(Times given in minutes)

Even the best DC2000 system is no faster than a high-speed floppy disk backup system. The reason to choose a DC2000 system, then, is because it gives you the ability to hold 40 megabytes in one package rather than on 3 dozen high-density—or over 100 double-density—floppy disks. The QIC-100 standard used by the ADIC and Talgrass systems is not limited by the speed of the floppy disk controller, as is the QIC-

40 standard used by the Mountain Computer and Archive Corp. units. However, current implementations do not exploit this standard's full speed potential. In comparison, the Genie 3200 Series DC 600 system can back up BIGFILE in just over 2 minutes and doesn't require you to preformat the tape, making it your best choice when performance counts most.

| | Format time | BIGFILE Backup time | Restore time | SCATTER Backup time |
|---|-------------|---------------------|--------------|---------------------|
| Mountain TD4440 Mountain Computer Inc. | 54.5 | 5.9 | 4.8 | 13.2 |
| Archiva XL 5540 Archive Corp. | 42.8 | 11.4 | 6.8 | 27.8 |
| ADIC TD-440 Advanced Digital Information Corp. | 41.0 | 13.1* | 35.0* | DNF† |
| Irwin 145 and Irwin 445 Irwin Magnetic Systems Inc. | 39.5 | 9.1‡ | 5.1 | Error§ |
| MDI External MT-40P/AT Micro Design International Inc. | 38.3 | 8.9 | 6.8 | 33.5 |
| Alloy APT-40 Model 500 Alloy Computer Products Inc. | 38.3 | 8.9 | 6.8 | 33.8 |
| TG-1040e HS Talgrass Technologies Corp. | 38.0 | 9.3 | 6.9 | Error¶ |

* Using the TD-440's SARCHIVE utility

† Did not finish because backup process required more than 10 hours.

‡ Without verification.

§ Did not finish because the program was unable to handle the number of files and/or subdirectories and reported an error.

The BIGFILE performance test measures a backup system's ability to deal with large database-like files. The test creates a hard disk environment containing a single 10-million-byte (exactly) file that the systems reviewed here backed up and restored.

The SCATTER performance test challenges a program's ability to back up files scattered in an elaborately divided DOS subdirectory structure. The test creates an inverted tree of 1578 subdirectories and fills each one with two files.

tually identical performance.

Based on Alloy's proprietary tape format (rather than the expected QIC-40 standard), the Micro Design system also requires you to format tape cartridges before use, a process that takes about 38 minutes. Each tape holds a maximum of 40 megabytes when all of the 20 available tracks are formatted.

In the Micro Design implementation, operation of the TTP-40 software can require a lot of waiting. For instance, when loading the control software, you must

wait while the tape's tension and the head are indexed before you're given control.

A single preliminary menu gives you a choice of system activities: backup, restore, and utility functions. Submenus activate the desired operations. Batch file and automatic backup operation at an appointed time are all available.

The portable design makes the MT-40P/AT an interesting alternative to Alloy's own unit. If you have a number of systems to back up regularly, it can be a workable solution.

MOUNTAIN COMPUTER INC. Mountain TD4440

Of all the tape systems here, the Mountain TD4440 is the only one that hints at the capabilities of the QIC-40 (revision D) standard. On long, contiguous blocks of data, it nearly achieves the speed of an advanced floppy disk backup system, requiring 6 minutes to back up the 10-million-byte file of the BIGFILE test.

The Mountain Computer tape drive itself represents a bold new move for the company: it's the first drive that Mountain itself manufactures. Although the drive mechanicals are compact enough to easily fit a 3½-inch form factor bay, its integral control electronics actually require a full 5¼-inch slot. Metal brackets and AT mounting rails extend the sides of the chassis so that it can fit into a full-size, half-height drive slot.

Unusual among these tiny tape transports, the Mountain uses a direct drive motor (no belt) and a clever helix-and-lever mechanism for raising and lowering the read/write head. There's no door to cover the drive slot, nor a cartridge-release push button. You just slide in a tape and pull it out when you're done.

As with most QIC-40 drives, the Mountain plugs directly into the 1.2-megabyte (500K-bit-per-second transfer rate) floppy disk controller electronics of an AT or compatible. The only other connection you need is for power.

Four floppy disks full of software ac-



EDITOR'S
CHOICE

FACT FILE

Mountain TD4440

Mountain Computer Inc.
360 El Pueblo Rd.
Scotts Valley, CA 95066
(800) 458-0300 (outside Calif.)
(408) 438-6650
List Price: \$795

Requires: 256K RAM; DOS 2.0 or later; AT floppy disk controller.

In Short: The fastest DC2000 tape backup system of its group. Capable of both file-by-file and image backups, it operates through your existing floppy disk controller under the QIC-40 standard.

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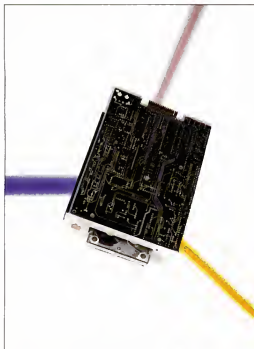
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CIRCLE 303 ON READER SERVICE CARD

POCKET-SIZE BACKUP



The Mountain TD4440 is the only system reviewed here that nearly achieves the speed of an advanced floppy disk backup system. The 1 1/4- by 5/8- by 8-inch TD4440 also stands out from other DC2000 systems because of its unusual direct-drive motor and helix-and-lever mechanism for raising and lowering the read/write head.

■ If you're as impatient as most AT owners, you'll welcome the TD4440's relatively high speed.

company the system. Installing this large amount of code is completely automatic and even allows you to stop halfway through if you just want to take advantage of its menu-driven features alone. The full package also allows command-driven operation.

This control software is obviously derived from Mountain's previous *FileSafe* series—and that means it's well-thought-out, clean, and generally easy to operate. All of the expected file-oriented back-up

features are available including whole disk, tagged, and selected file backups. You back up files chosen by date or archive attribute, and you can exclude files that you don't want to back up.

Full disk or partition image backups are also permitted. Commendably, individual file restorations are possible from these image backups.

A special AutoRun program will automatically make backups at an appointed time providing your system is idle and its clock is properly set. If you're using your computer at the appointed backup time, AutoRun will remind you that its time is due without interfering with your work. By using response files during batch operation in command-driven mode, you can custom-tailor the most exotic and complex backup sessions to run completely unattended.

If you're as impatient as most AT owners, you'll welcome the relatively high speed of the TD4440 system: its 6-minute

BIGFILE backup time is topped only by its under 5-minute restoration time for the same file. The multiple subdirectory environment of the SCATTER test required just over 13 minutes to back up, including nearly a minute devoted to tagging all the files.

The biggest problem encountered with the TD4440 was an unusual incompatibility with a device driver that shot the machine into the 23rd century, at least based on its time and date displays. Some interaction with the driver prevented the back-up process from being completed. Cleaning up CONFIG.SYS allowed the system to operate flawlessly. Mountain is investigating this situation.

TALLGRASS TECHNOLOGIES CORP. TG-1040e HS

At 7 by 4 by 14 1/2 inches, the Tallgrass Technologies TG-1040e HS can hold two full-size, half-height drive units. Besides holding its 5 1/4-inch form factor DC2000-based tape transport, it has a large enough power supply (50-watt) and enough mounting hardware and space to add a hard disk. In this way, you can make a complete external mass storage system with its own built-in backup. The Tallgrass tape system is also available as a bare drive for installation inside AT system units.

Its all-steel construction and office-equipment beige finish implies sturdiness



FACT FILE

TG-1040e HS

Tallgrass Technologies Corp.

11100 West 82nd St.

Overland Park, KS 66214

(800) 228-3475

(913) 492-6002

List Price: \$1,095 (external); \$795 (internal).

Requires: 256K RAM; 640K RAM recommended; DOS 2.1 or later.

In Short: A QIC-100-based tape backup system that uses a proprietary controller for file-by-file or image backups. Includes X-Tree and BackTrack for disk management and automatic time-controlled backing up.

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is pleased to
announce that
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QuickBASIC 2.0
is second best.



By any measure, Microsoft® QuickBASIC 2.0 was an outstanding success.

We'd taken all the things people loved in the BASIC interpreter, and added a ton of advanced features to make a compiler that was faster and more advanced than any BASIC ever.

A compiler that overwhelmed even the toughest judges:

“A snazzy new programming tool that bridges the gap between earlier BASICs and the high-performance languages like C.” Peter H. Lewis, *The New York Times*, July 15, 1986.

“(Microsoft QuickBASIC) ...represents an outstanding contribution to the microcomputer world.” Dennis Dykstra, *Byte*, February 1987.*

PC Magazine was so impressed, in fact, that they gave Microsoft QuickBASIC their Technical Excellence award. Before long, Microsoft QuickBASIC 2.0 was the most award-winning BASIC compiler ever.

But for us, excellence wasn't good enough.

Introducing Microsoft QuickBASIC 3.0.

We looked for more ways to make BASIC better.

Ways to make the programming easier and faster.

And then we set to work on what became Microsoft QuickBASIC 3.0.

Our first improvement was in debugging. Our new compiler includes an integrated debugger that is simply unparalleled.

Based on the technology of the famous CodeView® debugger included with our

C Compiler, it gives you complete control over your program and data. You can observe the contents of any variable. You have your choice of single-step, animate or trace modes.

You can even set dynamic breakpoints at runtime while still using the source for reference. Which lets you easily trace your program's operation without the bother of PRINT statements and recompiling.

This debugger is completely integrated into the compiler. So you can, for example, start debugging your program while it's running by simply pressing CTRL-Break. Instantly, the debugger is activated and you're in control again.

Faster math.

And faster programming.

On PCs equipped with math coprocessors, Microsoft QuickBASIC 3.0 blazes through calculations. Our new in-line 8087 code is as fast as you can get. And that's just the start of the speed advantages.

“Microsoft QuickBASIC is phenomenally fast in compilation. ... (it) outstrips all other compilers.” Marty Franz, *PC Tech Journal*, December 1986.

Fast compiling is nice, but it's not the most important consideration. Program development time is.

Microsoft QuickBASIC makes your programming substantially faster by integrating a sophisticated editor into the compiler itself.

Any errors found during compilation trigger the editor to take over, putting your cursor right on the

trouble spot.

And if you have more than one error, the editor will keep track of them all, letting you fix your bugs one after another. No more hassles with the endless recompiling of other compilers.

Divide and conquer.

Microsoft QuickBASIC gives you the power of advanced languages without the headaches. A case in point: separate compilation.

Long used in languages like C, separate compilation simply means that you can compile your programs the same way you write them, a piece at a time. Once compiled, your individual modules can be combined into libraries and added to future programs without the bother of recompiling.

But that's just one way Microsoft QuickBASIC supports structured programming.

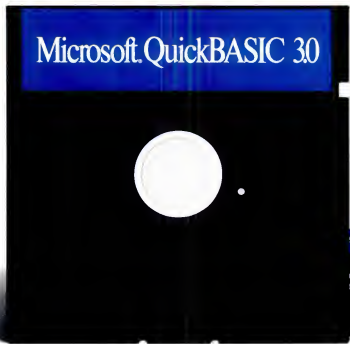
In addition to the previous Microsoft QuickBASIC extensions like block IF/THEN/ELSE statements, Version 3.0 adds a new set of control structures. Features like the new SELECT CASE, DO WHILE, and DO UNTIL make even the most complex programs amenable to reason.

Still the same. Only better.

After all this work on improvements, we didn't forget what made Microsoft QuickBASIC the success it is. This compiler is still the leader in BASIC compatibility. From graphics to sound, this BASIC commands the PC like no other.

For more Microsoft QuickBASIC advantages, just turn the page.

Introducing Microsoft QuickBASIC 3.0.



Integrated Program Debugging.

Microsoft QuickBASIC 3.0 includes the most advanced BASIC debugger available. This built-in debugger lets you track both program flow and the contents of variables with ease.

- ◆ Three debugging modes: single-step, trace, and animate.
- ◆ Set, clear, and examine breakpoints. NEW!
- ◆ Adjustable windows let you view source code, variable contents, and program output—all at the same time. NEW!
- ◆ Display and search through source code while debugging. NEW!

Advanced Integrated Editor.

The Microsoft QuickBASIC Editor is integrated with the compiler to make all your programming as fast and efficient as possible.

- ◆ Built-in editor places cursor on problem in source when error occurs in compilation.
- ◆ In contrast to other compilers that give up after finding a single error, Microsoft QuickBASIC's editor keeps track of all errors found during compilation. No more hassles with recompiling over and over.
- ◆ Editor supports both Insert and Overtype modes. NEW!
- ◆ Fully compatible with SuperKey,® ProKey,™ and SideKick!™ NEW!

8087 Math Coprocessor Support.

The standard Microsoft QuickBASIC math package has been enhanced to take advantage of numeric coprocessors in machines that have them. Now you have several ways to optimize your program's performance.

- ◆ Microsoft QuickBASIC 3.0 generates fast in-line code for machines equipped with 8087 or 80287 coprocessors. Now your programs can be as fast as the hardware allows. NEW!
- ◆ Microsoft QuickBASIC includes full 80-bit IEEE Math support

for programs that demand the most precise calculations possible. NEW!

- ◆ Choose from the Microsoft Binary Math routines for faster math or the new 8087 software emulation routines for more accuracy when you don't have a coprocessor.

Structured Programming Support.

In addition to the standard BASICA commands, Microsoft QuickBASIC Version 3.0 has a variety of advanced statements and features similar to those found in C and Pascal. By making structured programming easy, Microsoft QuickBASIC makes programs both easier to write and easier to maintain. Older BASIC features like line numbers and GOTO statements are strictly optional.

- ◆ New statements include SELECT CASE, DO WHILE and DO UNTIL, LOOP WHILE and LOOP UNTIL, and EXIT. NEW!
- ◆ Block IF/THEN/ELSE/END IF statements virtually eliminate any need for GOTOS.
- ◆ Subprograms may be called by name and passed parameters.
- ◆ Microsoft QuickBASIC now supports user-defined CONSTANTS. NEW!
- ◆ Both true local and global variables are supported.
- ◆ Microsoft QuickBASIC supports alphanumeric labels as well as line numbers.

Modular Programming Support.

Microsoft QuickBASIC's separate compilation lets you create stand-alone programs a piece at a time. You just compile your routines and add them to a library. Future programs can use those routines by simply linking in your libraries.

- ◆ Create stand-alone programs, with or without a separate runtime package.
- ◆ Link support routines once at beginning of a programming session, then forget about linking.

- ◆ Includes library for access to DOS and BIOS interrupts.
- ◆ Microsoft QuickBASIC makes it easy to use professional support libraries such as Softcraft's Btrieve package.

A compiler with both speed and power.

Microsoft QuickBASIC gives you the most advanced compiler features and debugging possible, without any speed handicaps. Microsoft QuickBASIC 3.0 compiles code up to an astonishing 12,000 lines per minute on an IBM® PC/AT.

Microsoft QuickBASIC also supports extra-large programs. Your programs can use all available memory for any mix of code and data. Individual arrays may use up to 64K bytes each (to the PC's limit of 640K).

BASICA Compatibility.

It's not hard to see why Microsoft's QuickBASIC is more compatible with IBM's BASICA than any other compiler. After all, we wrote it for IBM. And we've kept the same features in Version 3.0.

- ◆ Graphics statements include WINDOW, VIEW, DRAW, GET, PUT, LINE, CIRCLE, LOCATE, and SCREEN.
- ◆ Sound statements include SOUND and PLAY.
- ◆ Support for EGA extended graphics modes including the new 43 line mode.
- ◆ Supports standard BASICA structures such as GOSUB/RETURN, WHILE/WEND, and event handling.

Dramatic execution speed enhancements.

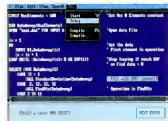
| Benchmark | Microsoft QuickBASIC 2.0 | Microsoft QuickBASIC 3.0 |
|------------------------|--------------------------|--------------------------|
| Graphics (500 Circles) | 21.42 | 9.83 |
| Floating Point Math | 16.92 | 6.48 |
| Quick Sort | 5.27 | 3.02 |

All test results in seconds. Tests were performed on an IBM PC/AT equipped with an 80287 coprocessor and an 8 MHz clock.

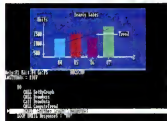
Microsoft® QuickBASIC

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Programming is easier with the built-in editor that searches for all errors, letting you correct them and recompile without leaving the programming environment.



Pinpoint errors by tracing through your source code with the integrated debugger. You can set breakpoints and observe the contents of variables.

Microsoft®

■ POCKET-SIZE BACKUP



The TG-1040e HS measures 7 by 4 by 1 1/2 inches and can hold two full-size, half-height drive units. It has a large enough power supply and enough mounting hardware and space to add a hard disk. These features make it possible for you to create a complete external mass storage system with its own built-in backup.

and long life. And, in fact, the Tallgrass external TG-1040e HS is a heavyweight for a little system.

Built around mechanicals that should fit a 3 1/2-inch form factor, the Tallgrass drive (like the Mountain) uses a 5/4-inch-wide circuit board for its control electronics and direct-drive motor. The Tallgrass drive has a head-positioning mechanism different from that of the Mountain and a large push button to release and eject cartridges.

The TG-1040e conforms to the QIC-100 standard, although the company calls it PC/T in its documentation. In fact, Tallgrass's PC/T was the precursor to the QIC-100 standard.

As with all QIC-100 systems, the TG-1040e HS requires its own interface: a full-length, XT-height, 8-bit bus expansion board that plugs into its host computer. A meter-long cable connects the TG-1040e chassis to the interface board, and the chassis plugs into a standard wall outlet.

The Tallgrass support software rates as

a mature product, derived from the company's well-received earlier tape systems. It provides both image and file-by-file modes with all the expected options, including selective backups by date and archive attribute. In addition, individual files or groups of files can be restored from an image backup.

Also included with the system is the Tallgrass automatic backup program, called *BackTrack*, and the *X-Tree* hard disk operating environment. *BackTrack* operates in the background and regularly backs up any new files or those that have been changed shortly after their creation or alteration. *BackTrack*'s only inconvenience is the slow system response when it's in operation. (This setup can be adjusted to fit your computing style to minimize its effect on your normal routine.)

Unfortunately, the normal (Tape Management System) backup software is not such a good match for the TG-1040e HS system. Entering the menu-driven section



EDITOR'S
CHOICE

• Mountain TD4440

If you're looking for a fast, trouble-free backup system, investigate a DC600-based cartridge system and forget the high-tech DC2000. Although putting 40 megabytes in your pocket is a great idea, these implementations are not a good match for the expectations of the AT user who has invested his dollars in a high-performance machine to eliminate waiting.

Of the systems evaluated here, however, the hands-down winner is the Mountain TD4440. It's the fastest, its software is up to just about any challenge, and it gives you nearly every backup feature you might need. The Tallgrass TG-1040e HS comes in a close runner-up in speed. And it includes a wealth of backup and utility software that puts it among the top choices.

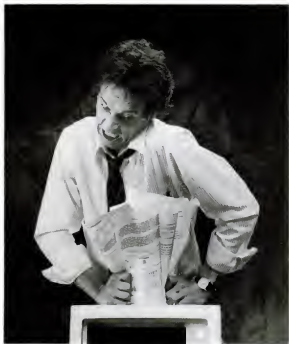
of the backup program entails a lengthy wait while the tape drive readies itself, typically a delay of about 50 seconds. In backing up the single-file, 10-million-byte BIGFILE test, the screen remains nearly blank with little hint of how things are going for nearly the total duration of the 9-minute process. Restoration of this file required just under 7 minutes.

Attempting to back up the SCATTER hierarchy of files and subdirectories with the TG-1040e HS system was completely unsuccessful and ended in the error message: "Failed to create directory entry." Consequently, the system failed to create a favorable impression on us.

Used only as a conventional backup system, the TG-1040e HS rates as rather ho-hum. However, used with *BackTrack*, it is a unique backup alternative, almost invisible, that does its best to keep your backups up-to-date.

Winn L. Rosch is a contributing editor of PC Magazine.

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Comdex booth #752, NCC booth #6109.

W

ORM (write-once, read-mostly, or many times) optical disk storage systems are fantastic machines based on laser beams and precision optics. Representing information by reflected patterns of light, they pack in up to 400 megabytes—the equivalent of several hundred books, thousands of CAD images, or nearly 10,000 facsimile pages—into cartridges the size of a stack of four floppy disks. And the drive units themselves are no larger than the floppy disk drives of the first PCs.

Unlike other backup systems, the WORM disk creates a permanent archive of the information it records. Because they are unalterable, WORM records cannot be accidentally or purposely changed or manipulated. As a result, WORMs are great when you want to create huge, enduring databases, need to maintain a full audit trail through months and megabytes of bookkeeping records, or require step-by-step backups covering the full evolution of a project.

Nor do WORM disks suffer from the ravages of time. While common phenome-

WORMs for Mass Storage

*Based on laser beams
and precision optics, WORMs
hold hundreds of megabytes
in a small cartridge.
Practically indestructible, they're
perfect for archiving and
data retrieval.*

■ WORMs

na such as the magnetic fields of telephone bells conspire against all forms of magnetic storage, today's optical WORM disks are safe from just about everything. The claimed life for WORM optical cartridges is 10 years, versus 3 years for magnetic media. As a result, you can expect the data on a WORM cartridge to endure longer than the expected life of the host computer.

The permanence of WORM storage comes from the way the systems store data. All WORM systems store information in the form of little depressions in the recording surface, which are created by a laser beam. Because these depressions correspond to irreversible physical changes on the disk's surface, they cannot be erased. (For more information on how this process works and how it differs from other optical storage media, see sidebar "Three Optical Storage Technologies," and "Optical Overview: What's Coming in CD-ROMs and WORMs." *PC Magazine*, Volume 5 Number 17.)

However, these advantages come at a price. The six WORM drive systems reviewed here—from Franklin Telecommunications Corp., Information Storage Inc. (ISI), Micro Design International (MDI), Optimum (see sidebar "AGA Discus 1000"), Optotech Inc., and Tallgrass Technologies Corp.—start at \$4,000. As a result, although the technology has generated a great deal of interest, it has yet to achieve widespread acceptance. However, IBM, in its April product roll-out, introduced an optical disk drive, versions of which are priced at between \$2,300 and \$2,900. This relatively low price for a 200-megabyte, 5¼-inch unit could help put WORMs within the reach of a wider range of users.

Nonetheless, you might be willing to pay that high a price if you need what today's WORM technology does best: archival backup storage and data retrieval. The demands of these two applications are entirely different, making some of the available systems better suited to one than to the other.

If you are typical of users who need a backup system, you probably hope you'll have a WORM (write-once, read-never) system rather than a WORM. Since you may never want to pry your data back off your WORM, the most important thing to

THREE OPTICAL STORAGE TECHNOLOGIES

WORMs, CD-ROMs, and Erasable Optical Disks are united in their use of optical storage technology, but all perform different functions.

The high storage densities that optical storage make possible have lured engineers into developing several different technologies that are sometimes seen as competing with one another. Among them are CD-ROMs and Erasable Optical Disks. Hardly competitors, however, the various optical mass-storage systems have purposes as separate and distinct as floppy and hard disks. They are complementary systems based on a similar underlying technology.

Despite their common design elements—lasers and small plastic-encapsulated metalized disks—WORM drives and the CD-ROMs that have recently received so much publicity are in fact very different systems. As the name obviously implies, the CD-ROM is a read-only memory device loosely based on the compact disc system that's been the hottest thing in the hi-fi world for the last few years. As with those musical CDs, CD-ROM disks can be written only at the factory by the specialized equipment. In contrast, the WORM is designed to be written on by the end user.

Quick, cheap mass production of CD-ROM disks already loaded with data is possible using methods such as those currently used for duplicating the audio discs. Thus CD-ROMs are an extraordinary information-distribution medium, capable of moving and storing many hundreds of megabytes of published text, numbers, and graphics images—all combined, perhaps, with audio and visual material.

The one-way data flow means that CD-ROM drives are much less expensive than WORM machines. While CD-ROMs start at less than \$1,000, WORMs cost about four times as much. The cost

savings come from economies of scale (because of the similarity of CD-ROMs to ordinary compact disc hardware and because they don't require high-powered lasers or extra circuitry to write data onto disk).

Although the functional difference between WORM drives and the long-awaited Erasable Optical Disk is only the number of times a given part of the storage medium can be written to, the two systems are fundamentally dissimilar. Although both systems are based on laser technology, their operating principles are quite different.

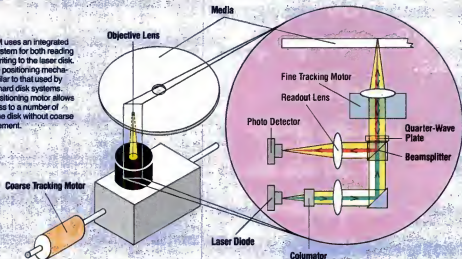
Most erasable disks are magneto-optical systems that rely on an optically bistable medium that can shift between two states of reflectivity (which may differ only by a few percent) under the joint influence of the laser and a magnetic field. The WORM drive, on the other hand, uses a laser to ablate a hole in a thin metal film (actually, the laser only pokes a tiny hole in the medium; surface tension enlarges it to its final form).

Getting the erasable systems to work is a tricky matter. For instance, the substances most commonly used for recording data bits change their reflectivity by only a few percent. While working Erasable Optical Disks have been successfully demonstrated for years, complete systems remain complex, expensive, large, and elusive.

The WORM is not an unsuccessful or incomplete Erasable Optical Disk system. In its present form, the WORM is a completely functional product with its own unique purposes. When used in the right applications, the unalterable nature of WORM data is a virtue, not a weakness.—Winn L. Rosch

How a WORM Works

The WORM uses an integrated focusing system for both reading from and writing to the laser disk. The coarse positioning mechanism is similar to that used by expensive hard disk systems. The fine positioning motor allows direct access to a number of tracks on the disk without coarse motor movement.



consider when backing up with a WORM is how fast and conveniently you can transfer information to it. As a result, the critical elements in forming your purchase decision should be the ease of use of the backup software (if any) accompanying each system and its speed in transferring information to disk. Although you need the assurance that the restoration process will work (and that you'll be able to recover as much or as little as you lost), restoration time won't be too important to you unless your disasters come with unusually painful regularity.

If you expect to work with your archives—searching through them for a particular phrase or drawing—speed in the other direction becomes more important. You need a system that reads from the disk quickly. For instance, if you plan to file your boilerplate forms and contracts on an optical disk or build a database of magazine articles, you'll want to be able to recall files fast.

When working with a WORM every day, you'll probably want a system in which files are structured in a form similar

to what you and DOS are used to working with. Most of the WORM systems examined here use a process termed "mounting" (derived from the mounting of tape databases in a mainframe system) to make optical files accessible to DOS. In these schemes, mounting a file or series of files maps part of the optical disk file allocation structure into a DOS-compatible format. Once a file is mounted, any program can read an optical disk file as if it were on a standard DOS device.

Other systems let DOS work directly with the disk—or promise you that ability. These systems give you the greatest freedom in selecting applications software.

DOUBLE STANDARD All the systems examined here are built from one of two optical cartridge drives, both of which are the same size as a full-height 5¼-inch floppy disk drive: the ISI 525WC from Information Storage and the Laser Databank 5984 from Optotech. The former has been available for about 2 years and, according to its manufacturer, currently holds about 80 percent of the market. The remaining

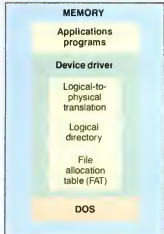
market share belongs to the Optotech drive, which has been available for less than a year.

The two systems use physically different cartridges, generally interchangeable between different drives of the same manufacturer but not between the two manufacturers. Both cartridges consist of a thin metallized-film medium encapsulated in a clear polycarbonate plastic disk. The actual disk is further protected by a high-impact plastic shell with a sliding metal door that allows access for the optical read/write head of the drive.

Although the two cartridge styles are about the same size—roughly 5¼ inches wide, 6 inches long, and ¾ inch high—they have different capacities. The Optotech cartridge can hold up to about 200 megabytes of formatted data per side. The Information Storage cartridge handles about 120 megabytes of formatted data per cartridge side. (Although not yet commercially available, Information Storage introduced a new system with nearly 500 megabytes of capacity per cartridge side at the Hanover Trade Fair this past March.)



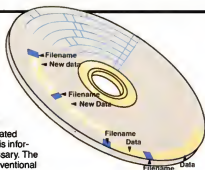
Storing Data on a WORM



Sequential Files

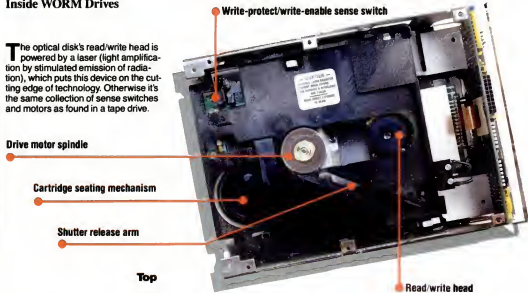
A sequential layout does not allow files to be updated or extended, but only copied. The directory and the file allocation table normally found on a disk are simulated in memory as part of the driver. This information is passed to DOS as necessary. The simulated disk looks just like a conventional DOS disk.

The logical-to-physical translation table is used to convert the logical DOS access information to the physical track and sector references on the laser disk. This conversion is performed for every read or write access. This approach allows any set of files on the WORM to be placed in the simulated disk. The sequential nature of the physical disk format lends itself to fast access.



Inside WORM Drives

The optical disk's read/write head is powered by a laser (light amplification by stimulated emission of radiation), which puts this device on the cutting edge of technology. Otherwise it's the same collection of sense switches and motors as found in a tape drive.

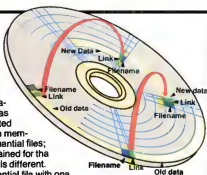


Linked Files

The linked-layout WORM allows files to be updated on a block basis. It also keeps a record of what has been updated by block. The simulated disk information (which is created in memory) is identical to the layout of sequential files; however, the way information is obtained for the logical-to-physical translation table is different.

A file is initially written as a sequential file with one exception: each block has an additional link, which is zero. This link can be changed because zeros in the laser medium can be overwritten. If information has been updated, this link is changed from the old block number to the new block number. The WORM disk drive is smart enough to know that the logical-to-physical translation table must be updated and that these links should be followed when building up the initial directory and file allocation tables.

The advantage of linked files is that they produce a large updatable medium with an automatic audit trail. The disadvantage is slow sequential access for files that have been updated.

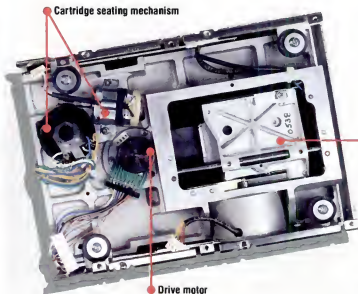


Externally, the cartridge resembles a larger-than-life 3½-inch floppy disk with access to the optical disk provided by a sliding shutter. The laser-activated read/write head bumps a hole in the disk's substrate when it writes data, making it a write-once, read-mostly (WORM) media. Sony is currently working on a truly erasable optical disk and plans to have test units available sometime in mid-1987.



Optical disk

Media access shutter



Bottom

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■ WORMs

Both styles of WORM disk are sold with the optical equivalent of a low-level format already in place, but each manufacturer uses its own method. The Optotech disk is grooved, stamped with concentric tracks for recording data. The Information Storage disk uses a flat medium onto which a laser blasts servo information. The Optotech disk format calls for 18,000 tracks with 22 sectors of 512 bytes each on each side. The Information Storage format has 14,900 tracks with 34 sectors of 256 bytes on each side.

Like floppy disks, both types of optical disks can be either single-sided or double-sided. Unlike magnetic media but similar to conventional vinyl phonograph records, you must physically flip the optical disk cartridges to access the second side.

The Information Storage drive uses a rack-and-pinion mechanism for moving its read/write head. The Optotech drive uses a metal band like that of a band-stepper hard or floppy disk. Both systems, however, are servo-controlled and use feedback to achieve high accuracy in positioning the massive optical head. The drives are slow, however: five to ten times slower than a

hard disk in moving their heads between random tracks.

You'll notice another difference between the two drive types when loading cartridges. With the Information Storage unit, you need only slide the cartridge into the drive. As the cartridge reaches the end of its travel, the drive mechanism automat-

ically lowers it down into its working position. You release the cartridge either with a software command from the host computer or by pressing a front-panel button (which doubles as a drive activity indicator). You can also use a software com-

mand to override the push-button release to prevent users from removing cartridges while the system is in operation. The Optotech drive adds a loading lever. Once you slide the cartridge into the drive, you rotate the lever to lower the cartridge and lock it into place. To release the cartridge, you swing the lever farther to the left, release the lever while the disk spins down, then rotate it all the way to the right. The cartridge then pops out.

In addition, the two WORM systems have a few operational differences. For instance the Information Storage drive is designed solely to write data sequentially from the inner tracks outward while building the disk directory from the outer tracks inwards. Optotech, on the other hand, uses a pointer system that allows data to be segmented, even scattered, across the disk. As a result, the Optotech system can better mimic DOS, while the Information Storage drive tends to read big blocks of data faster.

Here's a look at half a dozen WORM systems that you can plug into your PC. You'll find the reviews arranged in alphabetical order by manufacturer's name.

■ The Optotech system can better mimic DOS, while the Information Storage drive reads big blocks of data faster.

ically lowers it down into its working position. You release the cartridge either with a software command from the host computer or by pressing a front-panel button (which doubles as a drive activity indicator). You can also use a software com-



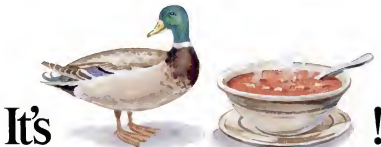
WORMs: Summary of Features

(Products listed in ascending price order)

| | ISI 525WC External Information Storage Inc. | N/Hance 525E N/Hance Systems | Franklin Telecomm FLD-200 Franklin Telecommunications Corp. | Optotech Laser Databank 5984 Optotech Inc. | TG-LightFile 7250 Talgrass Technologies Corp. | MDI LaserBank 400 Micro Design International Inc. |
|-------------------------------|---|--|---|--|---|---|
| List price | \$3,495 (internal) \$3,995 (external) | \$3,495 (internal) \$3,995 (external) | \$4,995 | \$4,995 | \$8,495 | \$8,995 |
| Price per megabyte | \$29.13 (internal) \$33.30 (external) | \$29.13 (internal) \$33.30 (external) | \$24.98 | \$24.98 | \$42.48 | \$49.98 |
| Price of single-sided media | \$139.95 | \$139 | \$150 | \$125 | \$150 | None |
| Price of double-sided media | \$224.95 | \$249 | \$225 | \$225 | \$225 | \$225 |
| Capacity (megabytes) | 120 | 120 | 200 | 200 | 200 | 200 |
| Size of unit (HWD in inches) | 6 x 10 x 12 1/2 | 5 1/2 x 7 x 15 1/2 | 6 x 10 x 16 | 3 1/2 x 5 1/4 x 8 1/4 | 15 1/2 x 8 x 17 1/2 | 6 1/4 x 10 x 17 |
| Internal or external | Both | Both | External | Internal | External | External |
| Direct DOS access | ● | ● (limited) | ○* | ● | ○† | ● |
| Support of DOS subdirectories | ○ | ○ | ●‡ | ● (limited) | ● | ● (limited) |
| Magnetic buffering | ○ | ○ | ○ | ○ | ● | ● |
| Support software | Optical device support only | Advanced text searching | Backup system, development tools | Optical device support, development tools | Device support, disk management | Optical device support |

● — Yes ○ — No *Franklin Telecommunications Corp. supplies unsupported software to allow DOS access. †DOS can access a magnetic cache; the optical disk is accessible only through a proprietary program. ‡In backup only.

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■ WORMs

FRANKLIN
TELECOMMUNICATIONS CORP.

Franklin Telecomm FLD-200

Perhaps the one application in which optical storage will first win acceptance is in making backups, and that's where Franklin Telecomm's FLD-200 succeeds best. With Franklin's \$4,995 *Archive Management System*, the FLD-200 is definitely a formidable backup system, capable of managing 200 megabytes per cartridge side at a time.

Despite its foundation in still-exotic optical storage technology, the FLD-200 ranks as one of the easiest systems to install and use. It's no more bother than a tape backup system, and much more permanent.

An external unit, the FLD-200 comprises a separate chassis containing an Optotech cartridge drive and power supply in an all-metal 6- by 10- by 16-inch (HWD) chassis, a controller/interface board, a connecting cable, and software.

The controller/interface, also made by Optotech, doubles as the system's host adapter. It's a bulky, two-card sandwich mated foil-to-foil that's XT-card height and a full 13½ inches long; the whole assembly plugs into an 8-bit bus expansion slot. However, skirts hanging down on the bottoms of both boards may make slotting the adapter a trial-and-error affair.

The connecting cable is about 29 inches long and allows you to place the FLD-200 chassis on either side of its host computer.

Franklin supplies three disks of software: one of its own *Archive Management*



~~~~~  
The Franklin Telecomm FLD-200 is an external unit containing an Optotech cartridge drive and power supply in a 6- by 10- by 16-inch chassis. With the *Archive Management System*, the system is capable of managing 200 megabytes per cartridge side at a time.  
~~~~~

System (AMS), another of a *File Management System (FMS)*, and one of developmental tools for writing your own C language programs for controlling the system. Franklin supports only the first of these; the others are Optotech software that Franklin does not support and advises you to use at your own risk.

You need use only the first disk to put the FLD-200 to work as a backup system. Normal operation requires no software drivers or other operating system modifications. You simply run the *AMS* program, and it takes care of the details.

AMS controls the optical cartridge system, copies files from magnetic to optical disk and back again, and allows you to peruse what's on the optical cartridge. The interface is a menu-driven system that prompts for all the required inputs, such as asking you for the names of files to back up. Although in some ways rudimentary, it is sufficient for implementing a worthwhile file-by-file archiving system.

The *AMS* software can automate the

backup (or restore) process using *Archive Command Files* (saved lists of files to back up and not to back up). Although the system prefers to list and restore only the latest version of files, this can be overridden. You can restore files either to their original directory location or anywhere else on your disk.

Backing up with the *AMS* software is slower than streaming to DC600-style tape cartridges but on par with DC2000 and fast floppy-disk backup systems. Moving 10 megabytes to optical storage takes about 5½ minutes. Restoration is much more time consuming, requiring over 20 minutes.

The *File Management System*, which the company recommends only for advanced users, allows you to manipulate files on the optical disk in a command-driven mode through a set of utilities that mimic DOS. In addition, a device driver is supplied so that some DOS functions and applications can directly access the optical drive. Using the utility *OMOUNT*, up to



FACT FILE

Franklin Telecomm FLD-200

Franklin Telecommunications Corp.

733 Lakewood

Westlake Village, CA 91361

(805) 373-8688

List Price: \$4,995; single-sided media,

\$150; double-sided media, \$225.

Requires: 512K RAM, DOS 2.1 or later.

In Short: A 200-Mbyte-per-side WORM system with software that functions best as an easy-to-use backup and archival system.

CIRCLE 678 ON READER SERVICE CARD

Case History #60341

"Arco Petroleum Products comes to mind," said Bill Kilpatrick, of The Software Works! of Glendale, California. "It was a big project. Arco had already been through two expensive failures with other companies who could not deliver the custom software they needed. It was a Point of Sale system, a cash register interface and custom-accounting software for their entire franchised chain of convenience stores, gas stations and auto tune-up centers. It had to be done fast and it had to work. Our competition proposed a dBASE III+ solution. We proposed DataFlex. I said, 'I'll make a challenge, if we can't deliver the completed project faster

using DataFlex, following the exact specifications that have already been laid out, then Arco doesn't have to pay us a dime.' We knew we could do the job right and we knew we could do it faster with DataFlex."

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us. Features like the macros, the program generator and report generator enable us to do more, using less code, in a lot less time."

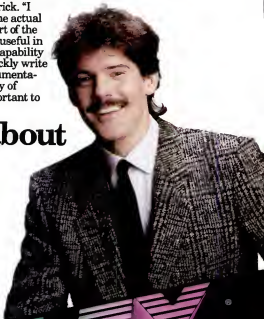
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PC MAG 623

Data Access Corporation

14000 S.W. 119 Avenue
Miami, Florida 33186
(305) 238-0012

TELEX: 469021 Data Access CI
FAX: (305) 238-0017

■ WORMS

32 megabytes of optical files at a time can be mounted for these manipulations.

Franklin's reservation of *FMS* for advanced users is indeed justified. The *FMS* commands are complex and involve combinations of logical unit numbers and hexadecimal base addresses for optical disk partitions. Think of the *FLD-200* foremost as a backup system that lets you experiment with optical technology.

INFORMATION STORAGE INC.

ISI 525WC External

According to Information Storage Inc. (ISI), the 525WC drive is the most popular WORM on the PC market today. It's also an established product, introduced over 2 years ago, that can pack roughly 120 megabytes per side of a Superstore 2000 cartridge.

The 525WC drive is available as either an internal or an external system priced at \$3,495 and \$3,995, respectively. Internal versions come with either a black full-height front panel for XT systems or a half-height beige panel for the AT. Although the 525WC requires a full slot, it fits in the bottom of the AT's right drive bay with only its top half visible.

The chassis of the 525WC External measures 6 by 10 by 12½ inches and amounts to little more than a beige all-metal box for the drive with a power supply tucked inside. It connects to the host system through about 2 feet of cable with male DB-25 connectors at either end.

The system uses a 5-inch-long, 8-bit bus interface card that fits into any AT or



~~~~~  
The chassis of Information Storage's drive measures 6 by 10 by 12½ inches and connects to the host system through about 2 feet of cable. The system uses an 8-bit bus interface card that allows either Program Input/Output or Direct Memory Access data transfers.  
~~~~~

XT expansion slot except the XT short slot nearest its power supply. The same interface allows either Program Input/Output (PIO) or Direct Memory Access (DMA) data transfers, selected by DIP switches and software.

Two software versions came with the evaluation system: *ISIDOS* and *PermaWrite*. We received a beta copy of *PermaWrite*, which is an update of *ISIDOS* and was released as the standard system software on April 1 of this year.

You install either package by making two entries for device drivers into the host computer's *CONFIG.SYS* file. Thereafter, the 525WC appears as an additional drive letter. However, it does not support all DOS functions, and you must mount files before they can be read or before executing programs on the optical disk. You can mount up to 511 files with a total size of less than 32 megabytes (Information Storage abides by the DOS limit) at one time.

ISIDOS limits direct optical disk access

to mounted files. *PermaWrite* allows DOS or applications programs to write directly to the 525WC, with some limitations. For instance, the optical disk does not support the standard DOS tree-structured subdirectory system.

Information Storage also supplies several utilities dedicated to optical disk use. *PCOPY* moves files from magnetic to optical disk and creates a subdirectory system. In the Information Storage scheme of things, a subdirectory links files together and makes groups of files easier to mount. *MOUNT* does the actual mounting. *PDIR* lists the files and subdirectories on the optical disk, separately or together.

Because files cannot be overwritten, you can write the same file (or different files with the same name) to the optical disk multiple times, and the system keeps them straight by automatically assigning a unique integer version number to each, up to a maximum of 65,536 versions.

Using *PCOPY* to move files to the opti-

(continues)



FACT FILE

ISI 525WC External
Information Storage Inc.
2768 Junette Rd.
Colorado Springs, CO 80906
(303) 579-0460

List Price: External, \$3,995; internal, \$3,495; single-sided media, \$139.95; double-sided media, \$224.95.

Requires: 256K RAM, DOS 2.1 or later.

In Short: A 120-Mbyte-per-side WORM system with fast read performance and limited DOS compatibility.

CIRCLE #77 ON READER SERVICE CARD



Monday



Tuesday



Wednesday



Thursday



Friday

It's time you forgot about tape backup.

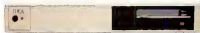
Tape backup is a lot like walking the dog. Sure it's a nuisance. But if you don't do it, you have to live with the consequences.

Enter IDEAtape.™ The fast 60 MB internal and external streaming tape drive for the IBM PC that lets you forget about backup. IDEAtape has a scheduling feature that enables the unit to backup automatically. At the same time each day, or at different times. For a week, a month, even years in advance.

You can perform high speed image backup, and even restore individual files from that image. You can back up only those files modified since last backup, or those made on or after a specific date.

There's more. IDEAtape works with most high performance systems. Including XT's, AT's, even the Compaq 386 at 16MHz. The same drive and controller combination works with all machines. Plus IDEAtape supports popular Novell® networks. And it fits neatly under your monitor for zero footprint. Call 800-257-5027 for more information.

With IDEAtape you won't lose your data. What's more, you won't waste your time.



IDEAssociates™
The Leader in PC Technology.

CIRCLE 694 ON READER SERVICE CARD

IDEAssociates, Inc., 29 Dunham Road, Billerica, MA 01821, (617) 663-6878, Telex 6979706; France, Switzerland, Germany, United Kingdom, Hong Kong.
IBM is a registered trademark of International Business Machines Corporation. Compaq 386 is a registered trademark of Compaq Computer Corporation.

AGA DISCUS 1000

More than twice the size of the other 5¼-inch WORM drives reviewed here, the Discus 1000 holds a gigabyte of storage on a single cartridge.

With a gigabyte of storage in a single cartridge, the AGA Discus 1000 may be the largest drive you can connect to your PC. A giant among these 5¼-inch WORM drives, the Discus 1000 will dwarf even an AT system unit.

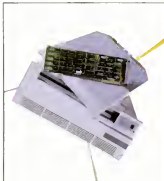
The Discus 1000 is based on an Optimum WORM drive made by 3M that was originally designed for minicomputer use. Evidence of that origin is the rack-mounting hardware that accompanies the system, designed to let you slide the huge 7- by 19- by 26½-inch chassis into the same cabinet with your DEC PDP-11 or whatever.

The Discus 1000 cartridges themselves are huge, too—giant plastic shells measuring 13 by 16 inches and ¾ of an inch thick. Hidden safely inside is a disk that measures a full 12 inches in diameter—the LP of WORMs.

Ordinarily you wouldn't think of attaching such mass to a PC. Advanced Graphics Applications has adapted it to the PC environment, however, and provides both the necessary hardware and software.

As the company name implies, this system is designed primarily for storing and manipulating huge graphics files. AGA offers complete systems—including AT computers, laser printers, and the Discus 1000—so you can buy a total turnkey graphics environment with a gigabyte of storage.

Once you find a place to put the drive chassis, installation is pretty straightforward. First, slide the AGA host adapter board—a full-length, XT-height expansion card that provides an SCSI interface—into any 8- or 16-bit slot. Next run the 6 feet of ribbon cable between the card and the drive chassis. Plug everything in (the drive sucks its lifeblood electricity from a standard wall outlet), and you're ready for software installation.



The AGA Discus 1000 chassis measures 7 by 19 by 26½ inches. The system is designed to store and manipulate huge graphics files.

PC MAGAZINE FACT FILE

AGA Discus 1000

Advanced Graphics Applications Inc.

530 Fifth Ave.

New York, NY 10036-5198

(212) 391-5560

List Price: \$17,690; single-sided media,

\$365; double-sided media, \$548.

Requires: 27K RAM for program plus an

additional 7.5K RAM for each allocated

buffer in CONFIG.SYS; DOS 3.2 or later.

In Short: The Discus 1000 uses huge car-

tridges that hold a gigabyte of data.

CIRCLE #79 ON READER SERVICE CARD

Again, the process is less unusual than the mass of the system would lead you to expect. It requires only the addition of a reference to the AGA device driver in the host computer's CONFIG.SYS file. Do that, boot up, and you're on your way.

The Optimum system is both similar and different to smaller WORMs. It uses

a recording medium that is identical except for its size, and the same basic laser-based storage techniques. As with smaller WORM cartridges, the big ones can also have one or two sides, each capable of storing half a gigabyte. The cartridge must be physically flipped to access the other side.

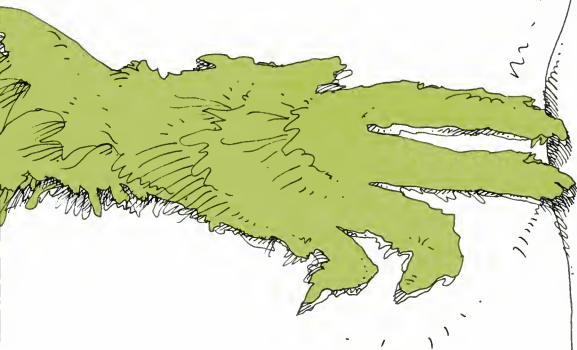
Cartridge construction and use are quite different, however. Loading a cartridge is a multistep process. First you must flip a rocker switch to the Stop position. You must then slide the cartridge into a slot marked A, which is protected by a hinged door. Once you've got the cartridge in all the way, you must pull it back out again. The disk itself stays in the drive, however, and only the shell comes out. A slot marked B, just above A, becomes a convenient storage place for the shell. Rock the switch to the Start position, and the drive comes to life, spinning the foot-wide platter up to speed.

From there on, the system runs like an ordinary DOS device. In fact, in some ways it's too much like a DOS device—it wouldn't let us duplicate filenames (notwithstanding that we couldn't erase the old files).

Worse yet, the current implementation of the software is about as bullet-proof as Saran Wrap. We encountered many difficulties in attempting to run benchmark test programs on it, and finally ended up corrupting the only cartridge that was supplied with the unit. The drive apparently did not like us, and after we created several directories that turned out to be filled with data from other files, the feeling became mutual.

Presumably you won't encounter these problems in the AGA turnkey system, but with 5¼-inch optical cartridges now up to 400 megabytes per side, there may be better strategies than buying your WORM by the pound.

—Winn L. Rosch



Horror

Brace yourself.

Be prepared for some tales that'll make your flesh creep and your blood run cold.

The problem comes about in many ways. Inadvertent command error. System breakdown.


Power source failure. Whatever.

The problem is data loss.

And it led to these true-to-life stories of unending horror that

could make you start regretting every moment you forgot to back up that important data of yours.

Read 'em and weep...



True-to-life
stories of
men and women
who didn't do
their computer
backup

and
lived to
regret it.

Stories.

Once upon a time there was a guy, let's call him Joe, who set up shop in the market research business.

He had a very small office, one corner of which was set aside for his computer.

Then one evening Joe got a visit from the data-crash monster.

It happened like this.

When he worked on the computer, Joe kept his diskettes next to him... in a shoe box, on top of a covered trash bin which doubled as a table top until he could get around to finishing the furnishings.

Each night before he left, he put the shoe box away in the desk drawer.

Every night but one.

Nearing completion of his first major research project, one evening Joe went home without remembering to take the diskettes off the trash bin.

The cleaning people took his diskettes out with the trash.

Oh, Joe was able to duplicate it, all right.

In a mere three months.

Joe now backs up everything but the laundry marks on his shirts.

So the monster got discouraged and went on to other victims.

Kurt, a playwright, was working on the last act of his new play, which had been in rehearsal for six weeks. After various rewrites,

Kurt was still agonizing over the right ending.

Two days short of opening

night, Kurt finally came up with the ending he wanted. He sat down to his computer and cranked it out.

After a few hours, when it was just about finished, the phone rang. As he

reached over to pick up the phone he somehow kicked the plug to the computer, and out of the socket it came.

(Kicking out plugs is one of the monster's specialties.)

Crash. That was the end of the ending.

Devastated because he knew he could never in a million years recreate it, he called the director and quit the show. The show never did open.

Finally, there's a horror story that actually happened to the writer of this copy.

I put together a compilation of idiomatic clichés once, with an eye to getting it published as a reference book.

In a move to another city I shipped some boxes ahead to be held by the hotel for my arrival.

Including one with the only copy of my book in it. Before my arrival it got lost in the shuffle.

Reconstructing the whole book was about as appealing as wrestling a jellyfish. Scratch one book.

But if you think those horror stories are bad, you don't know the half of it...



Behind every horror
horror story was



or story is another thing to happen.

Never relax your guard when dealing with the data-loss monster. Even if you've done your backup.

He has a one-two punch, you see.

He not only mauls the data you *don't* back up, he can also rip to shreds data you *do* back up.

Because those hard disks you're backing up aren't the only things that can suffer data loss, you know.

The backup media itself can have data loss, as the following gruesome details will show.

Data cassettes and video cassettes have an Achilles' heel monsters thrive on.

Their rollers and tensioners lack an independent support, and instead are part of the drive. Alignment problems may be the result.

Which means slipping and jamming.

Which means data loss.

Which means another victory for the insatiable data gobbler.

Don't go fleeing to floppies or backup software for mass storage protection, either. The Cruncher can mash them between his paws without half trying.

Floppies are great for

what floppies are for. Including even a little backup. But for backing up a lot of data, you'll not only get a tired arm slugging the things in and out of your PC, you'll get too much risk of crunching, crushing and creasing (deeds that data gremlins delight in perpetrating).

Imagine. You can even mess up your data by a simple fingerprint at the floppy's sausage-shaped opening. And if a fingerprint can mess things up, imagine what the big guy can do to your data with all his digits and limbs going at it.

Finally, some people are trying to outfox the monster by using a second hard disk that they only turn on when they need to use it.

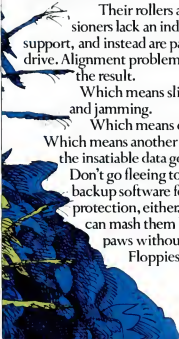
That's like protecting your home with a burglar alarm that's not turned on all the time.

Turning on the second disk some of the time just means it's only at risk some of the time. It improves your odds, but you're still at risk.

And if that hard disk isn't the removable kind, fate could remove some of your data in a generalized problem like a fire at the office that could sabotage both your backup and main disk.

So what do you do, surrender?

No, you turn the page...



The monster



meets his match.

All good monster stories have happy endings where the beast gets his just desserts, and this story is no exception.

3M has figured out a way for you to exorcise the demons of data destruction.

Data cartridge tape.

An inexpensive, easy-to-use way to store lots of stuff in very little space.

A cartridge is only 5¼" tall (its little brother is only 3½") but it keeps the data-loss monster at bay better than anybody.

Data cartridge tape is less expensive than half-inch tape or the removable, rigid disk-based systems. And in fact offers a lower cost per

megabyte than any other type of removable mass storage for the PC user.

More storage capacity, too.

Up to 150 megabytes.

The tape itself is fully enclosed in a tough plastic shell that data-loss monsters find particularly frustrating. It stands up to rough handling, and thus can survive monstrous attacks that floppies can't.

You don't have to worry about data-loss problems from improper handling of the tape, because you don't handle the tape. It stays put in the cartridge.

The tape is further protected by a built-in metal plate that supports the rollers and tensioners. This precisely controls the tape

alignment, preventing slipping and jamming of the tape — something which can cause data loss in cassettes. There's also a little protective "shutter door" that cassettes don't have, which closes over the tape when the cartridge is disengaged.

All of which pretty much does the data-loss monster in.

Leaving you with unequaled reliability, economy and convenience.

What more could you want in data backup? Not to mention

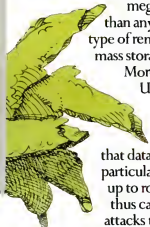
data cartridge's other functions, such as archival storage, data-base distribution, software distribution,

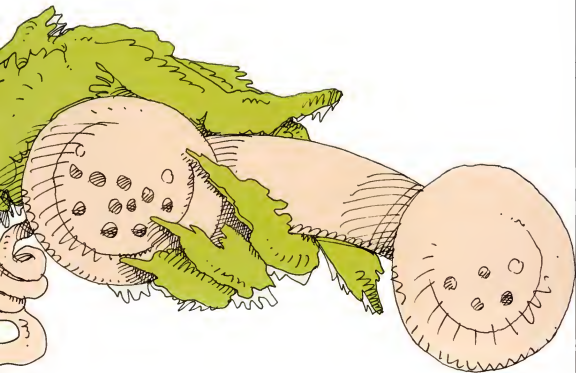
transaction logging, image storage, and data acquisition.

Finding the hardware isn't hard.

3M invented data cartridge technology to meet the needs of mass storage. And more and more manufacturers (over 150 at last count) are utilizing it in their designed-in cartridge drives and plug-compatible subsystems.

For a list of manufacturers who can answer your questions about data cartridge technology, turn the page.





(800) 423-3280
(And woe be to the monster.)

■ WORMs

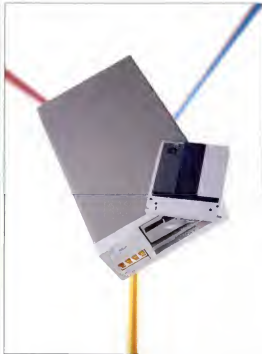
cal medium takes substantially longer than copying them to a hard disk—about 6 minutes for 10 megabytes versus 1½ minutes for a high-performance magnetic disk. The default verification that takes place during the copy process accounts for some of the time, however.

The 525WC's specified average access time is 200 milliseconds, which is slower than that of most hard disks. While using it in an AT, I noticed a slight delay when accessing the 525WC.

Once a file is mounted, however, it can be sequentially read from the optical disk using DOS at rates comparable to a medium-performance hard disk drive, roughly 5 megabytes per minute. Those speed-reading abilities make the Information Storage 525WC drive a fast bet for data retrieval systems.

MICRO DESIGN INTERNATIONAL INC. MDI LaserBank 400

Although built around the \$9,995 Optotech Laser Databanks 5984 optical drive that has a capacity of 200 megabytes per cartridge side, the Micro Design International LaserBank 400 improves on the original manufacturer's performance with a clever adaptation of the SCSI interface. Embedded in that interconnection is a 25-megabyte magnetic hard disk that functions as a high-speed data buffer. As a result, the MDI outperforms the Optotech original by 25 percent or more.



~~~~~  
The 6¼- by 10- by 17-inch MDI LaserBank 400 uses a clever adaptation of the SCSI interface. Embedded in that interconnection is a 25-megabyte magnetic hard disk that functions as a high-speed data buffer. As a result, performance is improved by 25 percent over the Optotech drive upon which the MDI is based.  
~~~~~

The host adapter for the MDI SCSI linkup is a 5-inch short card that plugs into any 8-bit slot in any PC-compatible. One such MDI adapter is sufficient to daisy-chain up to six optical disk drives—or other SCSI-based peripherals—to the host PC. The adapter in turn connects to the LaserBank 400 using a meter-long cable with a 36-pin Amphenol (Centronics printer-style) connector at either end.

Besides housing the Optotech drive, the moderately large (6¼- by 10- by 17-inch) LaserBank 400 chassis also hides a Mini-scribe 8425S 3½-inch magnetic hard disk that operates as the SCSI system's embedded buffer.

The LaserBank 400 chassis also functions as a power director. Four illuminated rocker switches decorate the front panel. One controls the power to the LaserBank itself, and each of the others switches a rear panel outlet. A single push-button-reset circuit breaker and a noise filter protect them all.

An automatic program installs the LaserBank 400 software, adding a driver to the host computer's CONFIG.SYS file and copying all of the LaserBank support software directly to the root directory of the system boot disk.

Once the MDI driver is loaded, you have direct access to the optical cartridge as one or more DOS devices. Files can be written to or read from the optical disk using standard DOS utilities or by applications that follow normal DOS file conventions.

All of the MDI software is menu driven and is controlled by a single batch file called the *LaserBank Management System (LMS)*. Individual functions can also be used in a command-driven mode.

Before a new optical cartridge can be used, it must be initialized using an MDI program that allows you to partition or record identifying information on the cartridge and even allows you to password-protect access to its data.



FACT FILE

MDI LaserBank 400

Micro Design International Inc.
6985 University Blvd.
Winter Park, FL 32792
(800) 228-0891
(305) 677-8333
List Price: \$9,995; double-sided media, \$225.

Requires: 512K RAM, DOS 3.0 or later.

In Short: A 200-Mbyte-per-side WORM system using an SCSI controller with embedded magnetic drive that allows magnetic file manipulations of files captured to optical disk for archiving.

CIRCLE #79 ON READER SERVICE CARD

■ WORMs

Before the host system can recognize the initialized cartridge, you must mount a designated storage area, again with MDI software. Before you can remove a cartridge, switch the system off, or mount another file area, you must unmount the previously mounted material.

■ The MDI LaserBank 400 outperforms the Optotech original by 25 percent or more.

To aid in mounting/unmounting groups of files, LMS allows you to record configuration files, which can then be loaded quickly at the press of a function key. You can then almost instantly recall previously loaded sessions from optical storage intact using a special "Flashback" provision, which eliminates the need for making a backup (or so MDI claims).

The added complexity of the mounting process is partially dictated by the hard disk buffer. Everything that you supposedly write to the optical cartridge does not necessarily go there—you're really working with the magnetic buffer. The buffer ensures only file changes that are optically written, conserving cartridge space and quickening access.

Operationally, this disk is invisible—it is part of the system and requires no special commands—but it speeds up system operation. Writing large files to the Optotech disk in the MDI is about 25 percent faster than Optotech's own system: While writing a 10-megabyte file took 8 minutes 21 seconds with the Optotech system, the MDI took 6 minutes 35 seconds. Repeatedly reading a sequence of 10K blocks was accelerated sixfold. After the block was read from the optical disk, repeated reads came strictly from the magnetic drive.

The LaserBank 400 system nevertheless operates at about one-third the speed of an AT hard disk when transferring large blocks of data (reading or writing). While it supports the standard DOS subdirectory structure, it pays no attention to the DOS

32-megabyte limit. However, large numbers of directories and short files can quickly deplete its directory space long before disk capacity is reached, as if DOS were storing all filenames and subdirectories in the root directory.

N/HANCE SYSTEMS N/Hance 525E

N/Hance adds advanced text-searching abilities to a basic optical cartridge drive to allow you to use the system for text-based databases.

The \$3,995 N/Hance system is based on hardware and software supplied by Information Storage Inc. The basic WORM unit itself is an ISI 525WC optical drive and is mounted in an external chassis that's little larger than the drive itself, measuring 5½ by 7 by 15½ inches. It connects to the host system through half a meter of cable equipped with male DB-25 connectors at either end.

This system allows you to pack about



FACT FILE

N/Hance 525E
N/Hance Systems
Division of Symphony Systems Inc.
908 Providence Hwy.
Dedham, MA 02026
(800) BUY WORM
(617) 461-1970

List Price: External, \$3,995; internal XT model, \$3,495; internal AT model, \$3,495; Model 524E read-only (external version) \$2,995; Model 524I read-only (external version), \$2,795.)

Requires: 256K RAM, DOS 2.0 or later.

In Short: A 120-Mbyte-per-side WORM system with limited DOS compatibility that really excels as both a text archiving and retrieving system.

CIRCLE 678 ON READER SERVICE CARD

120 megabytes on each side of a Superstore 2000 cartridge and achieves a claimed average access time of 200 milliseconds.



Advanced text-searching capabilities were added to the N/Hance 525E to allow you to use the system for text-based databases. The Text-Search program that accompanies the 5½-by-7-by-15½-inch drive reads through large blocks of text at 5 megabytes per minute, nearly as quickly as a hard disk.



HOW TO RUN A HARD DISK SYSTEM WITHOUT BACKUP.

Crossing your fingers is great when you're telling your mother-in-law you'd love to have her visit for a month. But, you are pressing your luck when you run your computer system without backup protection. Crossed fingers won't help when a crash wipes out your data and you have to spend hour after hour trying to retrieve what has been lost, recreate what has been forgotten or re-enter what is gone. But, a Cipher 5400 tape backup system can offer dependable security for that important data. Designed for today's high capacity disks systems on the IBM PC XT, AT and compatibles, the Cipher 5400 is available as a

stand alone, self powered unit offering 60 megabytes of fast backup and compatibility with such networks as Novell. The 5400 is completely read/write compatible with IBM's 6157 tape backup system. And, Cipher backs it with a two-year warranty and six-month warranty exchange program.*

Best of all, the Cipher 5400 frees your fingers for more important tasks, like signing contracts and shaking hands after a successful deal.

So, why not uncross your fingers and use one to dial 1-800-843-3751, Ext. 9; or within California, 1-800-722-0670, Ext. 9, for more information about the Cipher 5400 backup system.



CIPHER 5400 TAPE BACKUP SYSTEM.

cipher

* If your 5400 fails to operate within the first six months of use, Cipher will replace it. IBM PC XT, AT and IBM 6157 are trademarks of IBM Corporation. Cipher is a Registered Trademark of Cipher Data Products, Inc.

CIRCLE 232 ON READER SERVICE CARD

■ WORMs

In the host computer, the N/Hance system uses a 5-inch long, 8-bit bus interface card that fits into any AT or XT expansion slot, except the XT short slot nearest its power supply. To install the software, you make two entries in the host computer's CONFIG.SYS file for the two ISI device drivers.

Because the optical disk does not use a DOS format, moving data to it requires you to use the proprietary program IS-COPY, which takes substantially longer

■ N/Hance Systems*

Text-Search allows the system to rapidly scan files for specified text.

than using DOS COPY between magnetic disks. The software handles multiple versions of files with the same name by assigning a unique integer version number to each, up to a maximum of 65,536 versions.

You can read files from the N/Hance 525E using standard DOS utilities and applications after you mount them with a proprietary program, MOUNT. You can mount up to 511 files totaling 32 megabytes (to skirt the DOS addressing limits) at a time.

You can run the MOUNT program either in a blind mode by specifying files on the command line or more interactively by using a moving-bar menu and function keys. Although the system supports its own version of subdirectories, it segregates them from files and lists them on a separate MOUNT menu.

Once mounted, files on the N/Hance 525E can be read by programs as if they were read-only files on a hard disk. Programs will execute from the optical disk without difficulty.

The N/Hance enhancement to the ISI system consists chiefly of a program called *Text-Search*. As its name implies, this utility allows the system to rapidly scan files for specified text. You can also use it to retrieve images or anything else you can put



Performance Tests: WORMs

(Times given in minutes)

All of the systems tested here are designed for different purposes and use different software and interfaces. As a result, the timing tests are not directly comparable. However, these results show the general level of performance you can expect from a WORM system.

When you use DOS to work on the optical cartridge directly, most of these systems do not support standard subdirectories, and the ones that do (systems using the Optotech drive) do not reserve adequate directory space to deal with the 4,500 or more entries of the SCATTER environment. Therefore, we got no usable results for the

SCATTER test.

The test results for BIGFILE show that the units based on the ISI 525WC drive (ISI and N/Hance) were faster when reading and writing sequential data. The Optotech 5984-based systems (the other systems tested) worked more like DOS, but sacrificed speed and the number of allowable direct entries for that compatibility. While most of the systems tested were designed for on-line storage and retrieval, the Franklin FLD-200 was designed primarily for backup, and in its intended application the slow restore (read) time is not a severe disadvantage.

| | BIGFILE | |
|--|---------|------|
| | Write | Read |
| TG-LightFile 7250 Talgrass Technologies Corp. | 9.3* | 7.4† |
| Optotech Laser Databank 5984 Optotech Inc. | 8.4 | 5.6 |
| MDi LaserBank 400 Micro Design International Inc. | 6.6 | 5.4 |
| ISI 525WC External Information Storage Inc. | 6.2 | 2.0 |
| N/Hance 525E N/Hance Systems | 6.1 | 2.0 |
| Franklin Telecomm FLD-200 Franklin Telecommunications Corp. | 5.5 | 20.7 |

* This is a two-step process. First, we captured the file to cache memory on the magnetic disk, which took 2.2 minutes. Then we moved the file to the optical disk, which took 7.1 minutes.

† Reading the Talgrass optical disk is also a two-step process: Reading the data from the magnetic buffer took 1.5 minutes, from the optical disk, another 5.5 minutes.

The BIGFILE performance test measures a backup system's ability to deal with large database-like files. The test creates a hard disk environment containing a single 10-million-byte (exactly) file that the systems reviewed here backed up and restored.

into a disk file, as long as keywords are appended to the files.

More advanced than most PC text-searching programs, *Text-Search* allows you to use one or two key phrases (to search for) that you can link by proximity or by the logical operators OR, AND, or NOT. Rather than just searching text, the program filters through it, ignoring case, control characters, *WordStar* high-bit characters, intervening spaces, tabs, hyphens, and carriage returns. (You can change this filtering action through the configuration process.)

The *Text-Search* system allows you to view the target text in context. You can also pull text directly from the target file—for instance, grabbing the boilerplate

paragraph you might need for a particular contract.

The 525E optical disk system seems optimized for the *Text-Search* program: it reads through large blocks of text nearly as quickly as a hard disk, 5 megabytes per minute. And *Text-Search* seems to be optimized for the 525E optical disk system, working best in a single subdirectory and with no more than 500 files at a time—almost exactly what the system allows you to mount.

For about \$500 less than the WORM drive, N/Hance sells a compatible read-only unit (the 524) that lets you build your own databases and distribute them without fear that they might be accidentally augmented or tampered with in any way.



PROBLEM: The more experience your hard disk has, the harder it has to work.

THE SOFTLOGIC SOLUTION: Disk Optimizer™

Your hard disk will run faster when it's not chasing around after files.

Remember the old days when your hard drive was new? Remember that smooth, fast, slick performance? Those quick retrievals, rapid saves, lightning-like database sorts?

Well ever since, DOS has been doing its best to slow your hard drive down. Not by slowing down the motor, but by breaking your files up into pieces. Storing different chunks in different places. Data files, programs, overlays and batches that started out in one seamless piece are now scattered all over.

Loading is slower.

Sorting is slower.

Retrieving, backing-up.

Everything takes longer because your disk has to work harder.

Problem is, it's something that happens so gradually you may not notice the difference. At least, not until you see the dramatic improvement after using Disk Optimizer.

File fragmentation—It's a problem you can see.

Watch your hard drive the next time it reads or writes a file. Each "blip" of the LED means the drive-head is moving to another place on the disk—either to pick up or lay down another chunk of data.

And the truth is, head movement takes time. Far more time than actual reading and writing. What's worse, all this head movement causes extra wear and tear that can shorten the life of your drive.

Disk Optimizer—Tunes up your disk by cleaning up your files.

Disk Optimizer works by finding all the scattered pieces of your files and putting them

back together where they belong. Next time your drive reads it, there's just one place to look.

And the results are often dramatic. Reading and writing times may be cut by as much as two thirds. Database sorts that used to take hundreds of head moves now proceed quickly and efficiently. And since head movement is now at an absolute minimum, your disk drive will lead a longer, more productive life.

Analyze, scrutinize, optimize.

Before you optimize, you'll probably want to analyze. So Disk Optimizer shows you, in percentages, how much fragmentation has taken place—on the

entire disk, in individual directories, or for groups of files you specify using global or wildcard names.

Plus, there's built-in data security that lets you assign passwords to as many files or file groups as you want.

And the File Peeker gives you an inside look at the structure of files. It's a great way for non-programmers to learn more about computers, and a powerful tool for professionals who want to analyze the contents of their disks.

Get your hard disk back in shape—with new improved Version 2.0

Hard to believe, but new Disk Optimizer Version 2.0 is

even better than before. Not only will it optimize your disks in far less time than it used to, but it actually speeds up retrievals even more by letting you give priority treatment to your most used files, like programs and batches.

When you think about it, it's simple. The longer you own your hard drive, the more you come to depend on it. But the longer you wait to get Disk Optimizer, the less performance you'll get.

Use it just once and discover what thousands of satisfied PC users already know—\$59.95* is a small price to pay to restore the speed and performance you count on.

See Disk Optimizer at better computer dealers everywhere, or order today by calling SoftLogic Solutions at 800-272-9900 (603-627-9900 in NH). Or mail the coupon below.

Disk Optimizer \$59.95*

YES! Please send me _____ copies of Disk Optimizer at just \$59.95* each (not copy protected).

Name _____

Company _____

Address _____

City _____ State/Zip _____

Check Enclosed ☐ VISA ☐ MC ☐ AMEX ☐

Card # _____ Exp. Date _____

Signature _____

SoftLogic Solutions, Inc.
One Perimeter Road
Manchester, NH 03103
800-272-9900
(603-627-9900 in NH)

**SOFTLOGIC
SOLUTIONS**

Call today: 800-272-9900

*plus \$5.00 shipping and handling.

OPTOTECH INC.

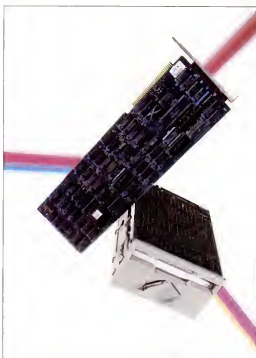
Optotech Laser Databank 5984

Optotech is a WORM cartridge drive manufacturer whose products are turning up in an increasing number of integrators' systems. The 5984 is Optotech's own internal system. Priced at \$4,995, the drive is capable of packing 200 megabytes on each side of an optical cartridge.

Optotech supplies its own controller to connect the drive to the host system. This controller is a bulky two-board sandwich, with the individual cards connected on their foil sides. One board operates as the disk controller; the other handles error correction. Both boards are XT-height and a full 13½ inches long, and the controller section plugs directly into a standard 8-bit bus expansion slot.

However, AT-style 16-bit bus slots proved to be a problem for the Optotech controller. Although some of the excess real estate on the broad boards has been eliminated so that the card set can bridge over the extra connector on a 16-bit slot, the rest of the board dips so low that it can interfere with some taller system board components, particularly socketed ICs. The slot into which you plug it may be somewhat restricted, particularly with some compatible computers.

The drive mounts internally and requires a full-height drive bay. However, its cartridge release lever poses problems in IBM PC AT installations. When you install the system in an IBM PC AT's internal drive bay, you have no access to this le-



Optotech supplies its own controller to connect the 3½- by 5¼- by 8¼-inch drive to the host system. The Optotech Laser Databank 5984 drive supports the DOS tree-structured directory system, but with some limitations that may affect the number of subdirectories and smaller files that can be stored on a single cartridge.

ver, and, when the drive is mounted in the lower two-thirds of the right-hand bay, the lever does not clear the lower part of the drive bay bezel. AT compatibles that give freer access to the fronts of drive bays, such as the XT Model 286, should pose no such installation problems.

Once you find space for the various Optotech components, you can connect them with a single ribbon cable and attach the drive to any unused cable from the host system's power supply. The WORM is then ready for operation.

Optotech supplies three varieties of software for making use of the 5984. The read/write device driver for the host system's CONFIG.SYS file is the easiest to use. Once you load this driver, you can use the optical cartridge drive just as you would other disk devices.

The Optotech drive supports the DOS tree-structured directory system, but with some limitations that may affect the number of subdirectories and smaller files that

can be stored on a single cartridge.

However, the match with DOS is far from perfect. When using the device driver, files must be mounted before DOS can access them. Some DOS utilities, such as CHKDSK, proved unable to operate properly on the Optotech system.

The second method of accessing the Optotech drive makes use of programs that can directly address the storage space without resort to DOS. This software is somewhat more cumbersome to use because it requires you to specify logical unit numbers as well as DOS device letters on the command line. Further, these logical unit numbers are defined by specifying sector offsets from the beginning of the optical disk using hexadecimal notation.

If that degree of control is not sufficiently intimate for you, Optotech supplies a library of C language functions that allow you to write your own software to make use of the optical drive.

The drive itself transfers larger blocks



FACT FILE

Optotech Laser Databank 5984

Optotech Inc.
740-770 Wooten Rd.
Colorado Springs, CO 80915
(303) 570-7500

List Price: \$4,995; single-sided media, \$125; double-sided media, \$225.

Requires: 128K RAM, DOS 2.0 or later.

In Short: A 200-Mbyte-per-side internal WORM system with moderate DOS compatibility that functions best when used as a developmental system.

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■ WORMS

of data to and from hard disks at about one-quarter the rate files can move between hard disks. Although this system from Optotech may prove invaluable to hardware developers, the enhanced products from the system integrators who use the Optotech drive will undoubtedly prove superior for everyday use.

TALLGRASS TECHNOLOGIES CORP. TG-LightFile 7250

Tallgrass Technologies takes the enlightened approach that magnetic and optical storage are complementary and combines both into a single integrated system. Magnetic technology, in the guise of a conventional hard disk, gives the \$8,495 Tallgrass system the advantage of speed. Optical disks endow it with unerasable archiving abilities and unlimited cartridge capacity with an awesome 200 megabytes available on-line at a time.

The entire system fits into a solidly built, free-standing vertical chassis that's 15½ by 8 by 17½ inches. Inside are a 230-watt power supply, a 50-megabyte (formatted) Control Data Corp. 94155-57 hard disk, 200-megabyte Optotech Laser Databank 5984 cartridge drive, five XT-size full-length expansion slots (three are occupied), and an extra full-height 5¼-inch drive bay. The whole system connects to the host computer through a half-meter-long cable that's nearly as thick and unruly as a water moccasin. The short length and relative inflexibility of the cable can make



The TG-LightFile 7250 integrates magnetic and optical storage into a single system. The 15½-by-8-by-17½-inch chassis contains a 50-megabyte hard disk, a 200-megabyte Optotech Laser Databank 5984 drive, five XT-size full-length expansion slots, and an extra full-height 5¼-inch drive bay.

placement of the system a real challenge.

The host interface is a short 5-inch expansion board that's XT height and uses the 8-bit XT bus. There's little circuitry on the card itself—only five integrated circuit chips—but it links the host computer to all the necessary ROM firmware inside the TG-7250 itself. The hard disk will function either as a first or additional drive; in the former case, it can boot the host system. The optical drive cannot.

But that's where any similarity to a DOS drive ends. You must partition the hard disk and format it with special utilities. Part of its available capacity—the default is half—is reserved as a buffer for optical disk operations. The rest can be used as normal DOS storage.

You can use the Tallgrass partitioning utility to slice up this DOS area into multiple logical drives. But if you would like to use any of the drives, including the optical disk, in addition to the first drive, first you'll have to install a device driver in the

host computer's CONFIG.SYS file.

Tallgrass furnishes complete instructions for this rather complex installation process. Odds are that you'll have to carefully read through them several times (and maybe even give a call to Tallgrass's tech support) to get the hang of the intricate set-up procedure.

According to Tallgrass, you need learn only one additional command to operate the optical disk: LT. You can use all your favorite DOS functions and application programs with the optical system (except FORMAT and similar hardware-dependent utilities) without encountering any problems. You can even use ERASE or DEL, and they work.

However, the Tallgrass optical disk is not erasable. The trick is that you don't ever deal with the optical disk directly, even when you are writing to or reading from its drive letter. These operations are actually carried out in the buffer area of the hard disk.



FACT FILE

TG-LightFile 7250

Tallgrass Technologies Corp.
11100 W. 82nd St.
Overland Park, KA 66214
(913) 492-6002

List Price: \$8,495; single-sided media, \$150; double-sided media, \$225.

Requires: 384K RAM, DOS 3.0 or later.

In Short: A 200-Mbyte-per-side WORM system with a 25-Mbyte magnetic buffer and a 25-Mbyte DOS hard disk that allows allows magnetic file manipulation of files captured to optical disk for archiving.

CIRCLE 879 ON READER SERVICE CARD

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CIRCLE 478 ON READER SERVICE CARD

■ WORMS

The optical disk is used only for archiving. Once you're done with your manipulations in the optical disk buffer, you can run the LT program and select the CAPTURE function to archive your files. CAPTURE saves the work you do in the buffer on the optical disk as a file, then allows you to name it and to identify it with a description. The CAPTURE process requires about 1 minute per megabyte of data in the buffer.

Once a file or group of files is captured, you can no longer modify it. However, you can manipulate original files that are still in the buffer, copy a previous session to the buffer, and work on it again (leaving the archive copy on the optical disk completely untouched, of course). The Optotech pointer system allows frugal optical storage of the changes that you make in the buffer.

When dealing with numerous short files and multiple directories, performance of the Tallgrass system lags. But when you work with the sort of files that optical media handle best—big ones—the combination magnetic/optical approach can boost the performance of the Optotech system considerably. For the most part, however, you'll be working on a conventional hard disk. The optical disk works as an interchange and backup device.

CONCLUSION

All of the optical storage systems reviewed here offer very different features and strengths. As a result, while we cannot select an Editor's Choice, we can offer recommendations for systems that will meet different needs. At \$3,495 for the internal model, the N/Hance 525E is the least expensive system, and it comes with a wonderful text archiving and retrieval program. The Franklin Telecomm FLD-200 is the easiest to use but offers fewer features than some of the other systems. Tallgrass's TG-LightFile 7250 and Micro Design's MDI LaserBank 400 share the idea of combining a magnetic disk, for use as a buffer, and an optical disk into a single system. While Tallgrass provides a hard disk with its system, Micro Design's system is easiest to use.

Winn L. Rosch is contributing editor of PC Magazine.

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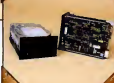
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Word Processor Translation Software: PRESERVING THE FORMATTED PAGE

Life in offices with multiple brands of word processing programs is getting faster, easier, and less expensive. Text conversion programs such as the five reviewed here—*PC-Switch*, *R-Doc!* *X*, *Software Bridge*, *Word for Word*, and *XWORD*—can take some of the credit.

Until recently, if you had a word processor file you wanted to read, edit, or print using another word processor, you went through time-consuming, frustrating, and sometimes expensive options. Managers at large corporations planning to switch to new word processing programs shuddered at the thought of having to convert thousands of files. Sometimes the best you could do was strip the original file of

Imagine WordStar files transformed to perfect WordPerfect files—with features such as underlining and boldfacing left intact? Here we review five text conversion programs that may seem simple, but they actually involve some complex programming, and no one program can do it all.

■ TEXT CONVERSION PROGRAMS

all formatting commands—boldface, underline, headers, footers, page numbers—and start right from scratch with raw ASCII text.

Outside consultants swapping *Microsoft Word* drafts with company staff using *WordPerfect* were stymied. So were technical people running *WordStar* when they passed disks along to the WP pool running *MultiMate*. If the formatting was as crucial as the underlying text, they had to resort to the overnight services of outside conversion houses or call in temps to reformat—or worse, retype—highly formatted files.

ENDLESS PARADE The increasing number of word processors exacerbates the situation. As recently as 5 years ago, only a few word processing programs, such as *WordStar*, *EasyWriter*, and *Magic Wand*, were available to PC users. The chances were that if you used *WordStar*, everyone else in your company used *WordStar*, and so it was relatively easy to pass along text files from one employee to another.

More than a hundred programs are now in use and, unfortunately, many of them impede the exchange of files from format to format. Unlike spreadsheets—in which case Lotus's 1-2-3 has at least three-quarters of the market and the nearest competitor, *SuperCalc4*, has near-perfect 1-2-3 translation capabilities—about five programs share the top three-quarters of the market: *WordPerfect*, *Microsoft Word*, *MultiMate*, *WordStar*, and *DisplayWrite*.

Although the problem has gotten worse lately because more users are using more diverse programs and systems than ever, it's not really new. In fact, text transfer has been a problem ever since microcomputers became business tools. Entrepreneurs and innovative types have used several solutions—none of them ideal.

Corporations that store data and text files on mainframe computers and need to transfer that information to their desktop PCs have frequently turned to hardware for the answer.

Several manufacturers produce hardware systems that pass data between incompatible systems. Flagstaff Engineering, in Flagstaff, Arizona, markets a floppy disk subsystem that allows users to

exchange data between 3½-inch, 5¼-inch, and 8-inch floppy disks from a variety of different systems and word processors. Another company, FormScan, in Hauppauge, New York, markets several hardware add-ons and boards that enable companies to read data from Wang and other dedicated systems and write them into PC-readable formats. (FormScan also sells its *Password* software directly for PCs on a flexible-cost basis, depending on how many transfers the customer re-

■ More than a hundred word processors are now in use, and many of them impede the exchange of files from format to format.

quires.) And many third-party companies handle the transfers for their clients' office.

While these systems may be the answer to transfers between conflicting computer systems, their costs are prohibitive for those who simply are looking for a way to convert formatted text files between two or more PC-compatible software packages. FormScan's *Codem 20* communications card, for example, which enables a PC to exchange formatted documents with a Wang, costs about \$2,500.

Companies with both dedicated word processors and PCs and need PC access to, for example, Wang documents, have a software option too. The accompanying sidebar "Accessing Dedicated Word Processor Files" discusses the problem of transferring files from a dedicated system to a PC format and offers some possible solutions.

ASCII LOSSES For file transfers from PC format to PC format, a cheaper—and generally faster—way to get around the problem is the ASCII route. Most PC word processors today are equipped either to accept ASCII files or to convert them into a style they can use. Thus many PC users ex-

change text files between conflicting software programs by converting the source file into ASCII format. This solution can be a satisfactory way to transfer pure text, but in the process you lose text enhancements such as underlining, tabbing, centering, and headers and footers.

As a result, a new type of utility is becoming popular: text conversion software such as the five programs reviewed here. In fact, the ability to convert word processing files is in such demand that some vendors of popular word processing programs also are getting into the file conversion act. They're beginning to offer a built-in solution. Just as many database programs can import and export files into different formats, a few word processing programs now include text conversion programs. The accompanying sidebar "Built-in Conversion" is a rundown on which programs offer built-in text conversion programs similar to the five standalone programs reviewed here.

Whether it's built-in or standalone, text conversion software is designed to perform what appears to be a simple job: taking a text file that has been produced using one PC word processor and rewriting it so it can be recognized fully by another, while retaining all or most of the formatting in the process. But this transformation actually involves a very complex bit of programming.

The same proliferation of programs on the market that's responsible for the demand for text conversion programs also is responsible for some of the difficulties these programs have handling the tasks they face. The variety of codes and commands word processors use to center a title or place a footnote can drive even well-planned transfer software a bit insane.

PROGRAM SUPPORT Naturally, one of the most important considerations in selecting a text conversion program is whether it can handle files from the word processors you work with and as many other files as you are likely to need to convert. Some users have had no choice in the matter: only one product currently on the market supports the word processors to and from which they need to convert files.

So if you collaborate with someone who uses *DisplayWrite* and you use *Summa*

ACCESSING DEDICATED WORD PROCESSOR FILES

Several products convert files from dedicated word processors to PC word processing programs.

The text conversion programs reviewed in this article are designed to solve the problems involved in changing from one PC word processing program to another. But what about companies that already have large investments in documents that were produced on dedicated word processors?

When these companies install PCs, they need PC access to documents previously created on their dedicated word processing system. The access crisis is especially great during the transition period, when some people are using PCs and others still are using dedicated word processors. When employees revise documents at this stage, they may need to translate them back and forth several times.

COMPLICATIONS Since dedicated word processors often use unique disk formats, converting word processor files is more complicated than just reading an MS-DOS file and translating formatting codes. The program must be able to manage the directory of the word processor's disk, and if it supports conversion to the word processor's format, it must be able to format floppy disks in that format.

Notwithstanding the inherent difficulties, a few vendors have solutions for companies confronted with this problem. Companies with Wang systems who need PC access to Wang-created files can find help from one of M/H Group's two products designed to simplify the conver-

| FACT FILE | |
|---|--|
|  | VsCom M/H Group 222 W. Adams St. Chicago, IL 60606 (312) 443-1222 List Price: VsCom PC terminal emulation and document file transfer software, \$395; Wang VS Transfer Utility (one per VS required), \$495, \$195 for 2110 terminal emulation only. Requires: 256K RAM, two disk drives, one serial port or internal modem, DOS 2.0 or later. In Short: A communications program for Wang VS users that emulates a Wang 2110 terminal and translates word processing files between Wang VS and MultiMate, IBM's DCA, WordPerfect, WordStar, OfficeWriter, Wang PC software, and ASCII. Not copy protected. <small>CIRCLE 101 ON READER SERVICE CARD</small> |
|  | Archive-Link M/H Group 222 W. Adams St. Chicago, IL 60606 (312) 443-1222 List Price: \$395 Requires: 256K RAM, two disk drives, DOS 2.0 or later. In Short: A program to convert between Wang word processor disks and MultiMate, DCA, WordPerfect, WordStar, OfficeWriter, Wang PC software, and ASCII. Not copy protected. <small>CIRCLE 102 ON READER SERVICE CARD</small> |

sion from a Wang word processor to a PC: *Archive-Link* and *VsCom*.

SOLUTIONS *Archive-Link* converts documents between the Wang archive format disk, used by the Wang OLS, VS, and Alliance word processors, and *MultiMate*, DCA Revisable Format, *WordPerfect*, *WordStar*, *OfficeWriter*, *Microsoft Word*, straight ASCII, and Wang's own PC software formats. The package can convert groups of files by wildcard and includes a program to format floppy disks in the Wang format.

VsCom is a communications package that emulates the Wang 2110 terminal and performs the same conversions as it downloads data from a Wang VS system. You must install a \$495 software module on the VS system to support the format conversion functions.

Users of dedicated word processors other than those from Wang may find products from AlterText in Boston, Shaffstall in Indianapolis, and Keyword in Vancouver, British Columbia, Canada, helpful. These companies make hardware/software systems for conversions between different dedicated word processors, and they now are supporting some PC word processing programs. Systems Compatibility, maker of *Software Bridge*, also makes a hardware/software product called DOC/Exchange, which will convert data from Wang and IBM Displaywriter systems to PC formats. —Howard Marks

Plus, you'll first want to look for a program that converts those files. How well the program converts all the formatting codes is the second consideration.

The type of text files you need to convert also can help determine the type of program you select. If you generally don't use footnotes, for example, you won't be too concerned if the program you select

can't convert them flawlessly. As with any product, especially a relatively new category of program such as text converters, your individual needs can quickly help you zero in on the essentials.

As you'll see in the reviews, these products all accommodate files from different lists of word processors, and they all handle their tough assignments with varying

degrees of success. No one product can do everything for everybody—yet. Adoption of a true industry standard would change the odds for future text converters.

DIFFERENT METHODS Some industry leaders have been trying to establish the IBM's DCA (Document Content Architecture) format as a universal intermediate

■ TEXT CONVERSION PROGRAMS

coding through which to process formatted text. Whether sold with word processors or as independent packages, most current text conversion programs, including those reviewed here, tend either to use their own intermediate coding or to bypass that method altogether in favor of more direct transfer.

The five programs reviewed here, which support a variety of word processors, tend to differ widely in their methods. Three of them, *PC-Switch*, *R-DocX*, and *Software Bridge*, work by creating intermediate files in a "universal" coding, which the programs then reinterpret into formats that the target word processor can read. (Even here they differ: *Software Bridge* and *R-DocX* create an intermediate file and then destroy it, while *PC-Switch* works solely in RAM.) *Word for Word* and *XWORD*, on the other hand, transfer text directly from one format to the other.

Both methods have advantages and disadvantages. Direct transfer tends to be much faster, which can be a significant factor when you are converting large numbers of text files.

The use of intermediate files, however, greatly simplifies the task of adding new word processors to a product's capability. Rather than rewriting the program to create links between each new word processor and its peers, the programmer arranges a conversion between the word processor and the intermediary format.

To test these programs, *PC Magazine* created a 3½-page document of about 1,000 words using three popular word processors: *WordStar*, Version 3.31, *WordPerfect*, Version 4.2, and *Microsoft Word*, Version 3.1. The document included running headers (with page numbers) and footers; a centered, boldfaced, and underlined title; several underlined and boldfaced phrases; a column of text; a column of figures using decimal tabbing; and a single-line footnote at the bottom of page one. (*WordStar*, Version 3.31, doesn't offer footnoting, but a footnote was created from a footer to use in testing the conversions. Not surprisingly, the footnote conversions caused some problems, as noted below.)

The test required each text conversion program to take the convert from among the formats of the three programs.

PROBLEMS None of the products tested here had much trouble converting such text-formatting options as underlining and boldfacing, and all managed to center the title. Headers and footers, however, proved to be somewhat difficult. In some cases the program transferred the one-line headers and footers without a hitch; in others it eliminated them altogether.

Page numbers were a big problem, tending to disappear even when they were part of an otherwise successful transfer. The column of numbers that used a decimal tab also caused a few headaches.

The big stumbling block was the footnote, especially since, unlike *WordPerfect* and *Word*, *WordStar*, Version 3.31, doesn't offer footnotes other than as footers. Thus most of the products we reviewed encountered problems converting the footnotes in our files; either the footnotes appeared within the main text where the numbering should have been, or the text conversion programs eliminated them altogether.

As an experiment I took a few of the converted files and ran them back through the programs to their "original" formats. This "reconversion" proved a failure; if you plan to do several conversions on a single document file, you'll want to check the results carefully. In fact, until you're sure that the conversion software you use can handle your usual text enhancements, you'll want to check all converted text files to make sure they're readable and complete.

The manufacturers of the text conversion programs acknowledge the complexity of translating files from one word processor format to another. Most of them include in the product manuals lists of text enhancements that the software can and cannot handle. (It's a good idea to check these lists before attempting to transfer a heavily formatted file—at least so you know what to expect.)

In addition, *PC-Switch* and *Word for Word* produce optional reports that specify where the software hit a problem and what corrective action it took (it usually adds a replacement character). And *Word for Word* and *Software Bridge* will, in certain cases, embed specialized characters within the text to help you solve problems. You can do a search-and-replace operation to

find these characters and substitute the correct ones in the converted document.

OPEN ACCESS Handling every formatting code perfectly for every word processor remains a challenge for future versions of these programs and new entrants in the market. But finding a conversion program that can convert files created by another word processor into files your word processor can use is like discovering a key to once-forbidden territory. As users of file conversion software programs such as the five we next review can attest, the ability to exchange files in differing formats—quickly, inexpensively, and without losing formatting—opens up a lot of closed doors.

The five programs are reviewed in alphabetical order by product name.

—Barbara Krasnoff

PC-Switch

Principal Systems' \$495 *PC-Switch* has a great many good intentions. Unfortunately, they pave a road that does not lead to a particularly useful product, albeit one that converts versions of *WordStar*, *MultiMate*, *DisplayWrite 2* and *3*, *Samma Plus*, *Samma Word*, *WordPerfect*, and *Microsoft Word*.



FACT FILE



PC-Switch
Principal Systems Inc.
6611 Bay Circle, #100
Norcross, GA 30071
(404) 449-8718
List Price: \$495
Requires: 640K RAM,
two disk drives, DOS 2.0

or later

Word Processors Supported: Writes *MultiMate*, Versions 3.31, 3.5, and 3.6x; reads *MultiMate*, Versions 3.2, 3.30, 3.31, 3.50, 3.60; *DisplayWrite 2*, 3, and 4; *WordStar*, up to Versions 3.3 and 3.32; *Microsoft Word* (all versions); *Samma Plus*; *Samma Word* III, Versions 2.0 to 3.0; *WordPerfect*, Version 4.2.

In Short: Notwithstanding its interesting Audit Report feature, this program has too many problems converting files to make it worth considering. Not copy protected.

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— Gary N. Prague, Author, "The dBase III Programming Handbook"

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— Computer Language

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Not copy protected.

CIRCLE 530 ON READER SERVICE CARD



THE SOFTWARE
BOTTLING
COMPANY
OF NEW YORK

■ TEXT CONVERSION PROGRAMS

SETUP *PC-Switch* starts off on the wrong foot by assuming that you're going to boot from a working floppy disk rather than a hard disk, and it suggests the hard disk is the perfect place for storing backups. That suggestion will come as a shock to hard disk users, who tend to think the other way around.

In fact, the program is so hostile to hard disks that it will not allow you to specify the same disk for an original and a converted file. When testing the program, I was forced to put a copy of the text files on a floppy disk in my A: drive.

The first time you use *PC-Switch*, you tell it which two word processors you will be working with by typing their initials af-

give you the option of renaming the new files; they will be converted into documents bearing exactly the same name as the originals.

The program converted the *WordStar* file to *WordPerfect* with little trouble. It handled headers and footers with no problem (although it appended page numbers directly next to the right-hand headers, rather than on the left side of the page), and the footnote was in place. *PC-Switch* did, however, tend to produce files that spilled over the right margin every few lines.

The conversion of *WordStar* to *Word* also was relatively clean, even though *PC-Switch* lost the footnotes, headers, and page numbers. (Incidentally, you'd be wise to check your program disk rather than the manual to find out which word processors *PC-Switch* handles; my documentation had not been updated to include its capacity to convert *Word*.)

PC-Switch had much more of a problem making the transference into *WordStar*. The *Word* document lost the footers and the footnote; as a result, *PC-Switch* dropped page numbers into *WordStar*'s default position: bottom of the page, centered. In addition, the text overshot the right margin of 65 characters, and I had to reformat it using *WordStar*'s Ctrl-B command.

The *WordPerfect*-to-*WordStar* conversion failed totally. At the first short column of text (which directly followed the footnote referent), *PC-Switch* gave up the fight; it printed a line of ASCII characters and then lost the rest of the document.

AUDIT REPORT *PC-Switch* automatically produces the useful Audit Report, a rundown of the process of converting a text file from one format to another. The report includes a floppy disk reference number, input and output disk IDs (determined beforehand using *PC-Switch*), the format in which the conversions are being done, a listing of any problems that occurred during conversion, along with a brief explanation of how the program dealt with them, and the time it took to complete the job. You can send the Audit Report to your printer, a disk file, or directly to the screen (where it scrolls past so quickly it's almost unreadable).

While *PC-Switch* converts text using

intermediary files, it does so in RAM, which saves time but also requires that your computer have a large amount of memory: 640K bytes. That, along with its inflated price and so-so performance, makes *PC-Switch* a so-so choice in the text conversion market.—Barbara Krasnoff

R-Doc/X

Advanced Computer Innovations' \$149 *R-Doc/X* converts files to and from the widest range of word processor formats of any of the products reviewed here: *MultiMate*; *WordPerfect*; *WordStar*; Leading Edge's *Word Processor* (only from, not to); *OfficeWriter*; *PFS:Write*; IBM's *Writing Assistant*; *XyWrite*; *Microsoft Word*; ASCII document (with carriage returns at the end of each line); ASCII lines (with carriage returns only at the end of paragraphs); *Spellbinder*; IBM's *DCA/RFT*; *NewWord*; *PC-Write*; *Pmate*; *Volkswriter Deluxe*; and *DisplayWrite 3*—a total of 18 different word processor formats.

Using *R-Doc/X* is simply a matter of se-

■ Some programs transfer one-line headers and footers without a hitch; others eliminate them altogether.

ter the Switch command. After that you can simply type SWITCH to start the program, unless you wish to change the word processors you've selected.

PC-Switch assigns each operation to a function key. Its screens are divided into two windows: the left delineates each key's function, while the right shows the program's current values.

You can use *PC-Switch* without referring to its awkwardly written manual (in fact, to avoid unnecessary frustration, I recommend skipping it altogether), since the program has an excellent context-sensitive help system. For a full explanation of the use of any of the function keys, you simply press F1, which is the help key, followed by the key in question.

PC-Switch allows you either to immediately convert a full disk of files or to select specific documents from those available. When you choose to select documents, the program then gives you a choice of either selecting or excluding each file on the disk. *PC-Switch* doesn't



FACT FILE



R-Doc/X
Advanced Computer
Innovations
1227 Goler House
Rochester, NY 14620
(716) 454-3188
List Price: \$149

Requires: 128K RAM,

two disk drives, DOS 2.0 or later.
Word Processors Supported: *MultiMate*, Version 3.6; *Palantir Word Processor*, Version 3.0; *DisplayWrite 3* and 4 (DCA/RFT); *Writing Assistant*, Version 1.0; *Leading Edge Word Processor*, Version 1.3; *Lexisoft's Spellbinder*, Version 5.1; *Office Solutions' OfficeWriter*, Version 2.0; *Volkswriter Deluxe*, Version 2.1; *WordStar*, Version 3.3; *Microsoft Word*, Version 3.1; *New Star Software's NewWord*, Version 3.3; *Phoenix Computer Products' Pmate*, Version 3.37; *PC-Write*, up to Versions 2.55 and 2.6 or later; *PFS:Write* (all versions); *WordPerfect*, Version 4.2; *XyWrite III*, Version 1.2.

In Short: A document conversion program that supports a wide range of word processor formats (18 of them in all). Not copy protected.

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■ TEXT CONVERSION PROGRAMS



Text Conversion Software: Summary of Features for Selected Word Processors

XWORD Ronald Gens Software Co. List Price: \$45



Software Bridge Systems Compatibility Corp. List Price: \$149

| | MultiMate Advantage 3.6 | Word- Perfect 4.2 | WordStar 4.0 | WordStar 2000 Release 2 | XyWrite III | DECdX WPS 1.0 | Display- Write 4 | Microsoft Word 3.1 | MultiMate Advantage 3.6 | Samma Word III 2.0 | Volks- writer 3 1.0 | Wang PC 2.01 |
|----------------------|-------------------------------|-------------------------|-----------------|-------------------------------|----------------|------------------|---------------------|--------------------------|-------------------------------|--------------------------|---------------------------|-----------------|
| Variable type pitch | ○ | ○ | ○ | ○ | ○ | ● | ● | ● | ● | ● | ● | ● |
| Soft carriage return | ○ | ● | ● | ● | ○ | ● | ● | ● | ● | ● | ● | ● |
| Hard carriage return | ○ | ● | ● | ● | ○ | ● | ● | ● | ● | ● | ● | ● |
| Line spacing | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Underscore | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Bold | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Overstrike | ○ | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Hard hyphen | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Soft hyphen | ○ | ○ | ○ | ○ | ○ | ● | ● | ● | ● | ● | ● | ● |
| Indent | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Centering | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Full justification | ○ | ○ | ○ | ○ | ○ | ● | ● | ● | ● | ● | ● | ● |
| Right/left margins | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Regular tabs | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Decimal tabs | ○ | ○ | ○ | ○ | ○ | ● | ● | ● | ● | ● | ● | ● |
| Columns | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Headers | ● | ● | ○ | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Footers | ● | ● | ○ | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Footnotes | ○ | ○ | ● | ○ | ○ | ● | ● | ● | ● | ● | ● | ● |
| Supersubscripts | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Page numbers | ○ | ○ | ○ | ○ | ○ | ● | ○ | ● | ● | ● | ● | ● |
| Required page ends | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Stop codes | ○ | ○ | ○ | ○ | ○ | ● | ● | ● | ● | ● | ● | ● |
| Merge codes | ○ | ○ | ○ | ○ | ○ | ● | ● | ● | ● | ● | ● | ● |

PC-Switch Principal Systems Inc. List Price: \$495

R-Doc/X Advanced Computer Innovations List Price: \$149

| | Display- Write 4 | Microsoft Word 3.1 | MultiMate 3.6 | Samma Word III 2.0 | Word- Perfect 4.2 | WordStar 3.32 | Display- Write 3 | IBM Writing Assistant | Leading Edge Word Proc. 1.3 | Microsoft Word 3.0 | MultiMate 3.3 |
|----------------------|---------------------|--------------------------|------------------|--------------------------|-------------------------|------------------|---------------------|-----------------------------|-----------------------------------|--------------------------|------------------|
| Variable type pitch | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Soft carriage return | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Hard carriage return | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Line spacing | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Underscore | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Bold | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Overstrike | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Hard hyphen | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Soft hyphen | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Indent | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Centering | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Full justification | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Right/left margins | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Regular tabs | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Decimal tabs | ● | ● | ● | ● | ● | ● | ○ | ○ | ○ | ○ | ○ |
| Columns | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Headers | ● | ● | ● | ● | ● | ● | ○ | ○ | ○ | ○ | ○ |
| Footers | ● | ● | ● | ● | ● | ● | ○ | ○ | ○ | ○ | ○ |
| Footnotes | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Supersubscripts | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Page numbers | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Required page ends | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Stop codes | ● | ● | ● | ● | ○ | ● | ● | ● | ● | ● | ● |
| Merge codes | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |



Editor's Choice ●—Yes ○—No *Converts footnote into text rather than into footnote format.

All of the packages reviewed here translate text and formatting codes to and from several versions of each word processor they support. Since we could not include features from every version of

every word processor in this table, we summarize here the features for the latest version supported. You'll find a list of versions for each word processor in the fact file with each review.

| Word for Word <small>Mastersoft Inc. List Price: \$149</small> | | | | | | | | | | | | |
|--|-----------------------|---------------------|------------------|-----------------|-----------------------|--------------------|---------------|-------------------|-------------|--------------------|------------------|---------------|
| | Word-MARC Composer | Word-Perfect 4.2 | Word-Star 3.3 | Display-Write 4 | IBM Writing Assistant | Microsoft Word 3.1 | MultiMate 3.3 | Office-Writer 5.0 | PFS-Write C | Volks-writer 3.1.0 | Word-Perfect 4.1 | WordStar 3.31 |
| Variable type pitch | ● | ● | ● | ● | ○ | ● | ● | ● | ○ | ● | ● | ● |
| Soft carriage return | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Hard carriage return | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Line spacing | ● | ● | ● | ● | ○ | ● | ● | ● | ○ | ● | ● | ○ |
| Underscore | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Bold | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Overstrike | ● | ● | ● | ● | ○ | ● | ● | ● | ○ | ● | ● | ● |
| Hard hyphen | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Soft hyphen | ● | ● | ● | ● | ○ | ● | ● | ● | ● | ● | ● | ● |
| Indent | ● | ● | ● | ● | ○ | ● | ● | ● | ● | ● | ● | ● |
| Centering | ● | ● | ● | ● | ○ | ● | ● | ● | ● | ● | ● | ● |
| Full justification | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Right/left margins | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Regular tab | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Decimal tab | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Columns | ● | ● | ● | ● | ○ | ● | ○ | ○ | ○ | ○ | ● | ○ |
| Headers | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Footers | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Footnotes | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Super/subscripts | ● | ● | ● | ● | ○ | ● | ● | ● | ● | ● | ● | ● |
| Page numbers | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Required page ends | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Stop codes | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Merge codes | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |

| | MultiMate Advantage 3.6 | NewWord 3.3 | Office-Writer 2.0 | Palantir Word Processor 3.0 | PC-Write 2.6 | PFS-Write | Pmate 3.37 | Spell- binder 5.1 | Volks-writer Deluxe 2.1 | Word-Perfect 4.1 | WordStar 3.3 | XyWrite III 1.2 |
|----------------------|-------------------------------|----------------|----------------------|--------------------------------------|-----------------|-----------|---------------|-------------------------|-------------------------------|---------------------|-----------------|-----------------------|
| Variable type pitch | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Soft carriage return | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Hard carriage return | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Line spacing | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Underscore | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Bold | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Overstrike | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Hard hyphen | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Soft hyphen | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Indent | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Centering | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Full justification | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Right/left margins | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Regular tabs | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Decimal tabs | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Columns | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Headers | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Footers | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Footnotes | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Super/subscripts | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Page numbers | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Required page ends | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Stop codes | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Merge codes | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

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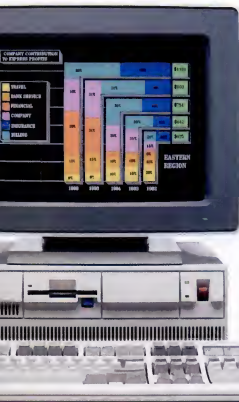
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■ TEXT CONVERSION PROGRAMS

lecting the source and the destination format from the respective menus and entering the source and destination filename. You can use full DOS paths, including wildcards.

R-DocX converts all documents to an intermediate, internal format and then to the target format. This system, while a little slower than one-step systems, greatly reduces the amount of work required to support a new format.

As *R-DocX* translates each file it displays the percentage of the file converted. And since no conversion program can convert every document perfectly, *R-DocX*'s manual points out those features that the program doesn't support. Unsupported features include headers, multiple columns (converted to a single column), footers, indexes, auto-outline, and tables-of-contents.

The manual also includes a short discussion of each of the file formats *R-DocX* works with and points out important facts, including the helpful warning that *PFS:Write* cannot handle files larger than 32K bytes.

R-DocX is shipped with a copy-protected disk along with the non-copy-protected disk in a sealed envelope. You can try the protected version and return the whole package if it doesn't meet your needs. If it's what you want, you can open the disk in the sealed package and put it to work.

PERFORMANCE *R-DocX* performed about as well as you would expect after reading the manual. It translated footnotes, headers, and footers badly if at all, as it warns you in the documentation. But, also true to its claims, it converted basic print control codes, such as center, underline, and boldface, flawlessly.

As you could predict from the manual, *R-DocX* had trouble translating the *WordPerfect* text document's use of multiple columns. In the converted file, the text in all the columns appeared squeezed together flush right.

In general, *R-DocX* made the same sorts of errors regardless of the formats it was translating, and all its errors were predictable from the information in the manual. It put headers at the top of files and footers at the end of files, but not on each

THE CONVERSION PROGRAMS: A COMPARISON OF RESULTS

To test the five packages reviewed here, *PC Magazine* created a 1,000-word document in *WordStar* 3.3, *WordPerfect* 4.2, and *Microsoft Word* 3.1, which all the packages supported. The document included typical formatting features: running headers (with page numbers) and footers; a centered, boldfaced, and underlined title; and footnotes. We converted the documents from each word processing format into each of the other formats. While the products handled most of these conversions with little difficulty, most ran into some problems converting documents into *WordStar*. The reason is that *WordStar* lacks certain formatting codes, such as columns and footnotes, handled by other word processors. As a result, the translating software either makes allowances for *WordStar* or crashes.

The screen shots below show this worst-case scenario: All show results using each package to convert from *WordPerfect* 4.2 to *WordStar* 3.3. Part of the text from the original document has been deleted to show more of the testing results in each screen shot.



Software Bridge takes nothing for granted; all the dot commands needed to format the document are on top of the file. The text of the footnote has been inserted within the body of the document in the spot where the footnote number was originally placed by *WordPerfect*. All the boldfacing and underlining have been transferred correctly.



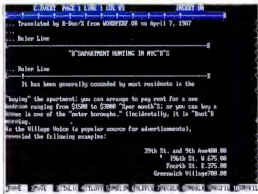
Word for Word has problems handling conversions from WordPerfect 4.2; thus it breaks down at the columns. (According to the manufacturer, this is not a problem with transference from WordPerfect 4.1.) Word for Word places fewer dot commands on top of the document; it has added an unnecessary **UU** (unjustify) command that did not have any effect on the printed document. All the boldfacing and underlining have been transferred correctly, although, as is shown here, the tabbing did not transfer.



PC-Switch had problems handling WordPerfect 4.2 footnotes when converting to WordStar, and lost the document completely after that point. However, it did transfer boldfacing and underlining correctly, as well as the headers and footers. Note the extra tab line that has been inserted: PC-Switch, like Software Bridge, takes no chances when transferring a document to WordStar.



XWORD could handle neither the footnote nor the decimal tabs and has omitted both from the converted document, a serious problem if your documents tend to use either. But it has placed the header and footer correctly in the dot commands at the head of the file, and all the boldfacing and underlining have been transferred correctly.



R-Doc/X had no trouble translating such formatting commands as boldface and center. However, it had difficulty with the columns. As you can see, all of the columns wound up flush-left and garbled. The footnotes were completely lost.

■ TEXT CONVERSION PROGRAMS

page. Footnotes disappeared completely or appeared at the end of the file.

Conversion speed was respectable. *R-Doc/X* converted a 1,000-word document in about 20 seconds.

HONEST SUPPORT *R-Doc/X* converts most of the simple formatting codes among 18 different word processing formats, but it doesn't (and doesn't claim to) handle conversions of footnotes, headers, and footers.

R-Doc/X's strength is the number of formats it supports. *Software Bridge* may do a better job of converting any given file or of handling complex formatting, but if you need to convert files from *WordPerfect* to *XyWrite*, for example, you'll want to look at *R-Doc/X* since it, not *Software Bridge*, works with those formats.

—Howard Marks

Software Bridge, Version 2

Software Bridge, from Systems Compatibility Corp., is an efficient, flexible \$149 word-processing conversion program. Except for a few glitches, it does a good job of converting word processing files created with many versions of *DECdX WPS*, *DisplayWrite*, *Microsoft Word*, *MultiMate*, *Sanna Word III*, *Wang PC*, *WordMARC*, *WordPerfect*, *WordStar*, and *Volkswriter 3*. And its user interface is more sophisticated than that of any of the other programs reviewed here.

Software Bridge uses a series of menus, which you can access by using the cursor or function keys. The opening screen gives you the choice of translating back and forth between the two word processors you chose the last time you used the program; if you need to translate a file created with a different processor, you can change to it easily by going to the separate Setup screen.

In Setup you choose which two word processors you want to work with by picking them from a list and "placing" each, using the cursor keys, into one of the two small windows labeled A and B. Here, as in the rest of the program, a well-written, context-sensitive help window appears when you hit the F1 key.



EDITOR'S CHOICE

FACT FILE

Software Bridge, Version 2
Systems Compatibility Corp.
One E. Wacker Dr., #1320
Chicago, IL 60601
(312) 329-0700

List Price: \$149
Requires: 384K RAM, two disk drives, DOS 2.0 or later.
Word Processors Supported: *DECdX WPS*, up to Version 1.0; *DisplayWrite 2, 3, and 4*, (DCA/RFT); *Writing Assistant*, Version 1.0; *Microsoft Word*, up to Version 3.1; *MultiMate*, up to Version 3.6; and *MultiMate Advantage*, Version 3.6; *Sanna Word III*, up to Version 2.0; *Wang PC*, up to Version 2.01; *WordMARC Composer*, *WordPerfect*, up to Version 4.2; *Wang PC*, up to Version 3.3; *Volkswriter 3*, Version 1.0.

In Short: An efficient and well-organized text conversion program that includes a flexible and sophisticated user interface. No copy protected.

CIRCLE 688 ON READER SERVICE CARD

FLEXIBILITY One of *Software Bridge's* great advantages is the extraordinary flexibility of its structure. It gives each word processor a variety of default values and formats, which you can easily alter through the Setup program. You can, for example, have the program name each new file using an automatically incrementing structure, opt for the original filename with an increasing extension (TEXT.01, TEXT.02, and so forth), or manually name each new file.

Once you've set up *Software Bridge* to your specifications, you return to the opening menu and indicate which word processor will be your source and which one will be your target. The program then presents you with the conversion screen, which asks you to name which file(s) you want to work with.

Software Bridge permits you to queue up to 99 files. And it lets you use standard DOS wildcards (for example, you can choose to convert FILES.*). If you can't remember the name of your source file, pressing the F2 key will bring up a directory of the subdirectory you specify; you then can scroll the directory and make your

selection by using the Return key.

Software Bridge is not very fast. Since the program works by creating an intermediate conversion file and then destroying that file, it takes about a minute to convert a 1,000-word document. If you have chosen to manually name the new text file, *Software Bridge* will stop halfway through the conversion process and ask for the new directory and file designation.

The program does an unusually efficient conversion job, though. The *WordStar* text files that it converted to *Microsoft Word* and *WordPerfect* came through with hardly a hitch. The *Word* document the conversion program produced was nearly perfect; although the footnote was missing in the printed document, it appeared in correct format within the file itself. The new *WordPerfect* document appeared to have all the features of the original *WordStar* document.

The two documents converted from *Word* and *WordPerfect* into *WordStar* didn't fare quite so well. In both cases *Software Bridge* dropped the footnote text directly into the text at the point where the reference number should have been. The file that came from *WordPerfect* was missing the page numbers, and the file from *Microsoft Word* picked up an extra Ctrl-S (which controls underlining) after the footnote, causing the last half of the document to be underlined.

All in all, though, *Software Bridge* did a superior job in converting the test files. Its performance, combined with ease-of-use and well-written documentation, makes it a valuable text conversion program. —Barbara Krasnoff

Word for Word, Version 2.06

Word for Word, from Mastersoft, is a neatly packaged and organized text conversion program. Designed to handle versions of *WordStar*, *MultiMate*, *WordPerfect*, *PFS:Write*, *Writing Assistant*, *Volkswriter*, *OfficeWriter*, and *DisplayWrite* (DCA/RFT), the \$149 program could be a very good product—with a bit more work.

You can operate *Word for Word* in two ways: in interactive mode, in which you specify through a series of menus each



FACT FILE



Word for Word,
Version 2.06
MasterSoft Inc.
4621 N. 16th St., #A-108
Phoenix, AZ 85016
(602) 277-0900
List Price: \$149
Requires: 256K RAM,

two disk drives, DOS 2.0 or later.

Word Processors Supported: MultiMate, Version 3.3; Displaywrite 3 and 4 (DCA/RFT); Writing Assistant, Version 1.0; Volkswriter 3, Versions 2.2, 3.1; Office Solutions' OfficeWriter, Versions 4.0, 5.0; WordStar, Versions 3.3, 3.31; Microsoft Word, Versions 3.0, 3.1; PFS:Write C; WordPerfect, Versions 3.0, 4.1, 4.2.

In Short: A well-planned but flawed conversion program that works well with some of its supported word processors but falls apart with others. Not copy protected.

CIRCLE 104 ON READER SERVICE CARD

document that you wish to convert, and batch mode, in which you simply type in a command-line series of options to speed the conversion of several documents. *Word for Word's* context-sensitive help screens appear when you press F1.

The opening menu for the interactive mode lists the possible source and target formats for conversion (you control which word processors will be listed by using *Word for Word's* install program). You choose the formats you wish to deal with by marking them with the Return key (the formats include a .COM program for sending formatted text over phone lines).

Once you've chosen your formats, you advance to the next screen, where you delineate the names of the source and the target file. Filenames can include directory paths, and *Word for Word* helps in this regard by listing all files on a drive or subdirectory on request.

Word for Word includes a handy report feature, which lists any problems it may have hit while converting a document. The program can exhibit the report in one of two ways: either as a separate file (you type WFW /PE when starting the program) or embedded within the document itself (you type WFW /PC). Exhibiting the report within the document itself is an interesting, useful way to handle features that

you know in advance may not be converted properly; when you see which coding the program uses to replace the problem coding, you can do a search-and-replace after conversion to reformat your document.

PERFORMANCE *Word for Word's* conversion process is fairly quick. A simple timeline graphic indicates how far the conversion is progressing.

The program did a fine job on the *WordStar*-to-*WordPerfect* conversion. All the text enhancements were in place in the new *WordStar* file, as were all headers and footers. *Word for Word* centered the title (although the blank line between the title and the first line of the document was lost), and it numbered and placed the footnote properly. In fact, the only problem with the new document was with the page numbers, which were indicated by a # sign rather than actually numbered.

Unfortunately, *Word for Word's* performance broke down on the *WordPerfect*-to-*WordStar* conversion. In fact, the file was so badly mangled that I called MasterSoft to find out what the problem was; technical support informed me that while Version 2.06 of *Word for Word* could convert documents to *WordPerfect*, Version 4.2, it was as yet unable to convert any documents from it (with the exception of *WordPerfect*, Version 4.1, files). I pointed out that the software package specifically lists *WordPerfect*, Version 4.2, as one of the word processors that *Word for Word* can handle both ways; they informed me they were working on it.

Word for Word also had problems converting from *WordStar* to *Word*. While the basic text formats were in place in the new document, the headers, footers, page numbers, and footnotes were missing. The most glaring problem was at the end of the text, where the last few lines of the tenth paragraph were removed and shifted to replace the last two lines of the document, which were pushed over to the next page.

The conversion from *Word* to *WordStar* went much better; the headers and footers were in place (although the page numbers were still missing). Yet the program mistakenly inserted the footnote within the text where the reference number should have been.

All in all, *Word for Word* has the potential to become a solid text-conversion program. Its tendency to hang up when a wrong key is pressed, together with its inability to convert at least one program that it advertises it supports, leads me to suspect, however, that even in Version 2.06, *Word for Word* may have been rushed prematurely onto the market.

—Barbara Krasnoff

XWORD, Version 2.24

Ronald Gans Software Co.'s *XWORD*, designed to handle *WordStar*, *XyWrite II*, *XyWrite III*, *MultiMate*, *MultiMate Advantage*, *WordStar 2000*, Release 2, and *WordPerfect*, Version 4.1, files, is a commercial version of the public-domain program of the same name. And as is the case with many utilities that cut their teeth on the network of on-line bulletin board systems, it is a no-frills product that does its job efficiently and well.

The version I tested, *XWORD*, Version 2.24, came with eight pages of printer-generated documentation, but the typeset manual should be out by the time this article appears. The program disk included not only *XWORD* but also the public-domain version of the program, plus an extra utility that converts non-ASCII into ASCII files for on-line transmission.



FACT FILE



XWORD, Version 2.24
Ronald Gans
Software Co.
350 W. 55th St., #2E
New York, NY 10019
(212) 957-8361
List Price: \$45
Requires: 128K RAM,

one disk drive, DOS 2.0 or later.

Word Processors Supported: MultiMate, up to Version 3.5; MultiMate Advantage, Version 3.6; Microsoft Word, Version 3.1; WordStar, Versions 3.3 and 4.0, and WordStar 2000, Release 2; WordPerfect, Versions 4.1 and 4.2; XyWrite II and III.

In Short: This unassuming yet efficient text conversion program has a few problems, but it's essentially well worth the price. Not copy protected.

CIRCLE 105 ON READER SERVICE CARD

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|--------------------------------------|-------------------------------------|--------------------------------------|
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| Duplicate directory structures | • | |
| Disk read-after-write verification | • | |
| Hot Fix™ | • | |
| Disk mirroring | • | |
| Disk duplexing | • | |
| Transaction Tracking™ | • | |
| Automatic rollback | • | |
| User-transparent data protection | • | |
| Multiple server support | • | |



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Milestones Ahead.

BUILT-IN CONVERSION

For text formatting conversion, you may have to look no further than your own word processor. But don't expect much.

You bought a new word processing program, but you still have 500 files in the format of your old one. Before you reach for the Excedrin or for one of the file conversion programs reviewed in the main article, check your new word processor. It may have a built-in conversion program that can do the job of a dedicated utility while saving you money.

If you bought *WordPerfect*, *Microsoft Word*, or *Manuscript*, you can breathe a little easier. The built-in converters in these programs (and the upcoming one in the next release of *XyWrite*) helpfully shoulder the job of converting files from certain formats—with varying degrees of success.

FROGS INTO PRINCES *WordPerfect's* highly capable Convert program imports files from *WordStar*, *MultiMate*, and IBM's DCA format, and it can export its own files back into all three. It also does the job significantly faster than any other built-in conversion program we've seen, and its conversions are both clean and comprehensive: *WordStar's* dot commands turn into *WordPerfect* codes as if they were frogs magically turning into princes. (You also can import *WordStar* and *dBASE* mail-merge files and spreadsheet .DIF files into *WordPerfect's* merge format.)

The CONVERT program works either from the command line or from a menu. Since it accepts wildcards, you can easily change a whole disk full of *.ws files into *.wp files with a single command.

Using *WordPerfect*, Version 4.2, without bothering with Convert, you can automatically remove end-of-line carriage returns from imported ASCII files and export ASCII files with returns only at the ends of paragraphs.



FACT FILE



WX, Version 1.8
Tech Knowledge
1728 11th Ave.
Seattle, WA 98122
(206) 328-4144
List Price: \$39.95
Requires: 64K RAM,
one disk drive, DOS

2.0 or later.

In Short: A configurable one-way *WordStar*-to-*XyWrite* conversion program so complete that your *WordStar* files are fooled into thinking they were *XyWrite* files all along. Not copy protected.

CIRCLE 88 ON READER SERVICE CARD



TextDCA, Version 1.3
CrossCourt Systems
1521 Greenview Ave.
East Lansing, MI
48823
(517) 332-4353
List Price: \$25

Requires: 128K RAM, one disk drive, DOS 2.0 or later.

In Short: Converts ASCII and *WordStar* files into DCA, while preserving page layout; accepts nonstandard file formats. Not copy protected.

CIRCLE 89 ON READER SERVICE CARD

THREE STARS *Microsoft Word's* Convs conversion program makes *WordPerfect's* Convert look good. *Word's* instruction manual proudly reports that when the word processor's Convs program imports *WordStar* files, it inserts three stars before each dot command so you can find them easily and manually convert them to *Word* formats.

But at least *Word* has a conversion program. In fact, it has more than one: Convs to convert *WordStar* files, conversion programs for *Ready!* and for

.DIF and *dBASE* files, and programs that convert documents from and to IBM's DCA format.

Convs takes more than 30 times as long as *WordPerfect's* Convert does when working with a *WordStar* file (and Convert translates the dot commands in the process, rather than just inserting stars for you to search and replace). Convs doesn't understand pathnames (*MS Word*, meet *MS-DOS*), and it doesn't accept wildcards, either. Plus, it forces you to enter the name of each input and output file at a prompt, and it sometimes leaves stray characters in the output file.

Word's conversion programs for *Ready!* and for .DIF and *dBASE* files perform better than Convs, but they won't help you with ordinary word processing documents.

If your documents are full of footnotes, don't expect too much from *Word's* programs that transform documents into IBM's DCA format and back again. Footnotes threw these programs into a state of confusion in which they misnumbered or repeated the footnotes or stripped them of references to the main text.

Even more seriously, I found that the *Word DCA* import program drastically truncated some of my files without any warning at all, including some files that *Word* had itself transformed into DCA format. Some of the files that *Word* converted to DCA format were rejected altogether by *WordPerfect's* Convert, and caused the conversion program in Lotus's *Manuscript* to create files with words jammed together on almost every line. Of course, DCA conversions never are exact—a lot of subtleties get lost in translation—but *Word's* can be downright misleading.

Some users report that for converting ASCII files to DCA format, they can't manage without Cross Court Systems' *TextDCA*.

XyWrite has no formal conversion programs at the moment, but an elaborate DCA converter will be available on request with the next version. (Unlike *Word* and *WordPerfect*, *XyWrite* will document its interpretation of the DCA standard.)

Until then, if you're converting to *XyWrite III* from *WordStar*, you simply can read your text into *XyWrite* by using the undocumented *Xlate* command in place of *Call*. (In *XyWrite II Plus*, the command was called *Translate*.) This command merely makes *WordStar* files readable; it doesn't convert layout or text attributes. For full conversions, nothing beats Tech Knowledge's *WX*, a one-way conversion program so complete that your *WordStar* files are fooled into thinking they were *XyWrite* files all along. (It does even better than *WordPerfect's* *Convert*.)

ONE-UPMANSHIP Lotus's *Manuscript* includes a reliable DCA converter, although it omits quite a few of IBM's layout commands. Yet, since *Manuscript* documents exactly what it omits, at least you'll know what to expect. (*Manuscript* also accepts *ThinkTank* outlines.)

WordStar, Version 4.0, apparently in the spirit of its glorious past, completely ignores all other word processing formats, including IBM's DCA. *Manuscript*, apparently looking toward the future, completely ignores *WordStar*.

—Edward Mendelson

Edward Mendelson is a frequent contributor to PC Magazine.

XWORD is so basic that it doesn't bother with such niceties as screen menus. To convert from one word processor to another, you write a command line sequence indicating which word processors and text files you're working with. A specific letter or number delineates each word processor format. To convert the *WordStar* file *TEXT.DOC* to a *WordPerfect* file named *CONVERT.DOC*, for example, you type *XWORD W D TEXT.DOC CONVERT .DOC* (the W stands for *WordStar*; the D for *WordPerfect*).

XWORD also supports straight ASCII files and, as a target only, *dBASE III* files. You can convert multiple files using DOS wildcards, and you can convert documents across different drives or subdirectories (but not to the same subdirectory on the same drive).

PERFORMANCE One thing must be said for *XWORD*: it's fast. While programs such as *Software Bridge* hum along for a minute or so, *XWORD* converted the file in a couple of seconds. And for the most part it didn't do badly, although it did have some problems.

XWORD succeeded in transferring the body of the document correctly from *WordStar* to *WordPerfect*. But while *XWORD* managed to transfer most of the

■ One thing must be said for *XWORD*: it's fast.

While programs such as *Software Bridge* hum along for a minute or so, *XWORD* converted the file in seconds.

boldfaced and underlined text properly, it lost the boldfacing and the underlining in the title. All of the paragraphs were tabbed properly, but the manuscript lost every one of its footers, headers, page numbers, and footnotes.

The document that *XWORD* converted from *WordPerfect* to *WordStar* fared better. *XWORD* transferred all of the text enhancements, including those in the title, without a hitch. But although the headers and footers appeared in the new document, the page numbers were missing. Also, *XWORD* added a five-character tab to the one that *WordPerfect* automatically generates, and so paragraphs in the *WordStar* document were therefore indented ten spaces.

But the most puzzling problem was the omission of a decimal column containing four figures. While *XWORD* is not the only conversion program that did not cope with the decimal tab of *WordPerfect*, Version 4.2, it was the first that handled the problem simply by eliminating the entire column.

XWORD doesn't yet handle *Word* files (although *Word* support may be available soon), and it doesn't have many of the extras its more-expensive peers offer. Individuals and small businesses who need to convert files only occasionally, however, will find *XWORD* both efficient and, at \$45, priced right for their needs.

—Barbara Krasnoff

Barbara Krasnoff and Howard Marks are frequent contributors to PC Magazine.

PC EDITOR'S CHOICE

• Software Bridge

The runaway winner in this particular race is Software Bridge, by Systems Compatibility Corp. Software Bridge not only produced the best results in PC Magazine's tests, but also gives users the most flexibility in file management and formatting options. But remember: the critical factor is whether the program supports the word processors whose files you need to convert. A so-so program that converts to and from your choice of word processor when no other program is available to do so can look like a winner.

Look At What The Editors Are Saying!



PC
MAGAZINE

PC Magazine Editor's Choice

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Vincent Puglisi PC Magazine Vol. 6 #3

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Winn L. Rosch
PC Magazine Vol. 6-3

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COMPAQ'S DESK PRO 286: THE 12-MHz CHAMP

It's all in the timing: rock-solid reliability and assured compatibility make Compaq the choice for fast, no-hassles computing. If only the options weren't so costly.

"What's the secret of being a great stand-up—"

"Timing."

"—comedian?"

In June 1984, Compaq showed IBM a thing or two about power and performance with the unveiling of the Deskpro. The 8086-based desktop computer provided an incremental but clear performance advantage over IBM's 8088-based PCs and XT's.

Compaq's top-of-the-world feeling lasted all of 2 months. That August IBM unleashed the PC AT.

Timing.

Compaq's new 12-MHz Deskpro 286 could suffer much the same fate, arriving 3 weeks before IBM's multimachine megannouncement of April 2.

Timing.

Regardless, the new Compaq represents the pinnacle of performance in the 80286-based world. Compared with the four 12- to 16-MHz AT compatibles from PC's Limited, Wells American, and Computer Classifieds reviewed in "High-Speed ATs: Life in the Fast Lane" (*PC Magazine*, Volume 6 Number 7), the Compaq nameplate means an additional measure of compatibility that moves 12-MHz computing from fast-but-risky to quick-and-safe.

Compaq engineers employed two techniques to ensure compatibility: one to cope with the few copy-protected (*hiss! boo!*) programs left that expect 6- or 8-MHz machines when they check drive A: for system disks, the other for finicky hardware such as network boards.

■ COMPAQ DESKPRO 286

30-MILLISECOND DRIVES The shock-mounted Deskpro hard disks—your choice of half-height 20 or 40 or full-height 70 megabytes—also went through similar speed training. Rated by Compaq at 30 milliseconds average access time, the 40-megabyte unit supplied with the test machine ran through the PC Labs BIOS seek (average access) test at a 27-millisecond

and clip. IBM PC AT disk drives are rated at 40 milliseconds and typically bench out at 37 milliseconds. XT disk drives run at 85 to 110 milliseconds.

If you decide to go the mail-order route to get a Deskpro, you'd better find out if you're getting genuine Compaq hard drives. A dealer can buy a Deskpro sans hard disk and slip in a perfectly adequate

40-millisecond Seagate to shave a few dollars off the price; there's nothing wrong with that as long as he's up front about it and lets you know that access times will be a third slower. In disk-intensive applications such as databases, word processors with overlay files, or network file servers, a slower drive may be more of a bottleneck than a slower CPU.

To back up all the disk capacity, you can add a 40-megabyte DC-2000 tape unit for \$799. The DC-2000 standard makes far more sense than the 10-megabyte DC-1000 toys of earlier Compaqs. A single controller card can run floppy disks, the 20- and 40-megabyte hard disks, and the tape backup. Only the 70-megabyte drive needs a separate controller.

FAST MEMORY Compaq supplies the 12-MHz Deskpros with 640K bytes of 100-nanosecond dynamic RAM (typical ATs use slightly slower 120-nanosecond DRAMs), with room on the motherboard for 2.1 megabytes. That's extended (RAM disk/print spooler) motherboard memory, not the more useful Intel/AST-style expanded memory for big 1-2-3 spreadsheets. You can convert extended memory to expanded memory with a program like Fort Software's \$89.95 V-EMM (see "Emulating Expanded Memory: Five Software Alternatives," *PC Magazine*, Volume 6 Number 6), but the all-software solution is markedly slower than a dedicated hardware/software solution such as the Intel Above Board.

If you want to go with an all-Compaq computer system, set aside \$1,398 for the Mitsubishi-looking EGA monitor and Chips and Technologies-based EGA board. It's an adequate monitor with a largish .40-mm dot pitch where most EGAs use .31 mm. For the details, see *PC Magazine's* reviews of the Compaq monitor and 17 other EGA and multifrequency monitors in "Behind the Screens," Volume 6 Number 6. The best feature of the Compaq EGA is its 5-foot signal cable, which means you can turn the Deskpro system unit on its side and stick it under your desk. Most everybody else's 3-foot cable forces you to cobble together a noisy cable-plus-extension-cable solution—and you wonder why the radio in the next office sounds a little raspy?



Compaq opted for near-complete reliability over ultimate speed; therefore, it throttles its 286 expansion bus to 8 MHz for greater hardware compatibility. Compaq supplies the 12-MHz Deskpro with 640K bytes of RAM, eight slots, and room for an 8-MHz 80287 math coprocessor. The keyboard emulates IBM's 101-key enhanced keyboard.



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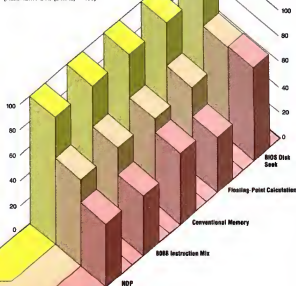


Benchmark Tests: Compaq Deskpro 286

The processor benchmark tests (NOP, 8086 Instruction Mix, Conventional Memory, and Floating-Point Calculation) clearly show the relationship between 8-, 12-, and 16-MHz clock speeds. The results are consistent: at 12 MHz, processor tasks are accomplished 1½ times as fast as at 8 MHz; 16 MHz runs twice as fast. Just do the math—12 divided by 8 and 16 divided by 8.

The BIOS Disk Seek test measures hard disk access time. Stated very simply, Compaq installs a hard disk that is faster than the one used by IBM. There is no functional difference between the hard disk found in the 12-MHz Deskpro and the one found in Compaq's 386 machine. The 16-MHz processor in the 386 has no impact on the hard disk access time. If you are seeking a performance improvement for a disk-intensive application, the speed of the hard disk becomes as important as the speed of the processor.

Relative Times
(Ratio IBM PC AT (8 MHz) = 100)



IBM PC AT (8 MHz)

Compaq Deskpro 286 (12 MHz)

Compaq Deskpro 386 (16 MHz)

Performance Times

(Times given in seconds except where noted)

| | NOP | 8086 Instruction Mix | Conventional Memory | Floating-Point Calculation | BIOS Disk Seek (milliseconds) |
|-----------------------------|------|----------------------|---------------------|----------------------------|-------------------------------|
| IBM PC AT (8 MHz) | 4.20 | 9.00 | 1.30 | 36.00 | 37.00 |
| Compaq Deskpro 286 (12 MHz) | 2.85 | 6.10 | 0.86 | 23.75 | 26.77 |
| Compaq Deskpro 386 (16 MHz) | 2.09 | 4.23 | 0.72 | 15.50 | 27.83 |

The **NOP** benchmark test is designed to measure raw clock-speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The **8086 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction code. These instructions are a subset of the total processor instruction set.

The **Conventional Memory** benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **Floating-Point Calculation** benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The **BIOS Disk Seek** benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

This Deskpro runs its Intel 80286 processor at 12 or 8 MHz. You can switch between them either by typing Ctrl-Alt-\ or by using Compaq's Mode Speed command. You can also opt to leave the Deskpro in a default Auto mode that runs at 12 MHz except momentarily during floppy disk accesses, when it drops back to 8 MHz. The speed sensor works in much the same fashion as the Escort radar detector in your BMW—you only have to slow down when you come to trouble spots, so your overall progress isn't greatly affected.

IBM made a big deal of its 6-to-8-MHz AT speed boost when it wasn't such a big deal. But the step from 8 to 12 MHz is another matter—10 MHz appears to be the point at which bus compatibility becomes a real issue. Unlike machines that run their expansion buses at 12 MHz, Compaq throttles the Deskpro 286 expansion bus back to 8 MHz for greater compatibility with hardware built with little tolerance for nonconformists. Compaq chose near-complete reliability over ultimate speed. If it's speed you want, another \$1,500 will buy you a Deskpro 386.

Timing.

While networks can be the death of too-fast PCs, in a sample network application using 3Com network boards and Banyan's VINES software linked to a Tallgrass server, nothing PC Labs could throw at the Deskpro made it skip a beat.

In the formal PC Labs benchmark tests, the Deskpro clocked in 1½ times as fast as a standard 8-MHz AT, about what you'd expect from a 50 percent jump in the clock rate. Tasks that take 10 seconds on the Deskpro need 15 seconds on an AT. You'll see PageMaker shed a bit of its sluggishness on screen redraws, Windows Write trace its bit-map characters without the wading-through-Jell-O feel you get on PCs and even on 8-MHz ATs, a 1-2-3 graph pop up faster when you hit View, and a dBASE sort return to the dot prompt a few seconds sooner. Type-A personalities should place orders today.

The new Deskpro runs neck and neck with the Compaq Portable III ("20 Pounds of AT Power," *PC Magazine*, First Looks, page 33, Volume 6 Number 7), which predated the Deskpro by a month and manages to stuff the same speed into a 20-pound lunchbox.

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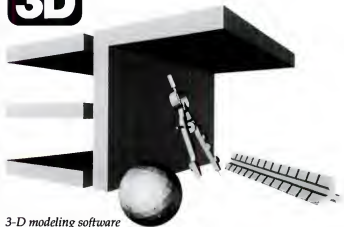
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■ COMPAQ DESKPRO 286



FACT FILE

Compaq Deskpro 286

Compaq Computer Corp.
20555 FM 149
Houston, TX 77070
(713) 370-0670

List Price: Model 1, \$2,999 with 256K RAM, 1.2-Mbyte floppy disk drive, Compaq Enhanced Keyboard, parallel port, serial port, Model 20, \$3,999 with 640K RAM and 20-Mbyte hard drive. Model 40, \$4,999 with 640K RAM and 40-Mbyte hard drive. 40-Mbyte tape backup, \$799; Enhanced Color Graphics board, \$599; color monitor, \$799; monochrome monitor, \$255; MS-DOS 3.1, \$85; MS-DOS 3.2, \$95; 100-nanosecond RAM, \$199 per 512K.

In Short: The best, most compatible high-speed 80286-based desktop computer around, with the usual Compaq ruggedness. Replaces the 8-MHz Deskpro 286 at the same price. Switchable between 12- and 8-MHz CPU speed, with an 8-MHz bus for added compatibility with network boards and copy-protected software. Some of the options (EGA, bigger hard disks) are a bit expensive if you pay list price.

CIRCLE 69 IN READER SERVICE CARD

SILENT KEYBOARD Physically, the 12-MHz Deskpro 286 looks about the same as any other Compaq Deskpro. It has the same tanklike construction, two-tone beige and brown paint job, two side-by-side drive bays that hold four half-height drives (or two half-heights and the 70-megabyte Winchester), and the quiet, soft-touch keyboard that most users don't like until they have to take notes while talking on the phone.

The keyboard is Compaq's perfect emulation of the 101-key IBM enhanced keyboard, right down to the Ctrl key tucked off in the lower-left corner, the CapsLock key directly to the left of the A key (where Ctrl should be), the 12 function keys lined up along the top, the inverted-T cursor pad, and the separate numeric keypad. Given that Compaq's keyboard has such a different feel from the IBM model, Compaq should give some serious thought to offering as a no-cost option a clickety-clack mechanical keyboard like IBM's. You can adjust the system unit speaker to produce a click every time you strike a key, but somehow it just isn't the same.

SIX FREE SLOTS Inside, the Deskpro 286 has eight slots (five full-length 8/16-bit, two full-length 8-bit, one short 8-bit), parallel and serial ports (one each, on the drive controller card), room for an 8-MHz 80287 math coprocessor (\$395), the standard AT clock, a beefed-up 192-watt power supply, and a security lock. Compaq's configuration leaves six of the eight slots free. The eight 256K-byte memory banks are socketed, not soldered. Since it's a Compaq, construction and workmanship are first-rate.

Absent from this Deskpro is Micro-soft's InPort device, which allows you to connect a mouse without using one of the only two serial ports DOS allows. (The custom InPort chip emulates Microsoft's bus mouse circuitry; the mouse attaches to a circular 9-pin connector.) Compaq almost included the InPort with the Deskpro 386 last fall on the EGA board, but found the cable and connector worked equally well as an ExPort for RF emissions. It hasn't been heard from since on Compaq products.

DOLLAR'S WORTH Buying the Compaq Deskpro 286 means you'll pay about the same as you would for an IBM. The \$2,999 price for the base-model Deskpro 286 with 640K bytes of RAM and only a single 1.2-megabyte floppy disk drive is about what you'd pay for a mail-order 12-MHz AT compatible equipped with a 30-megabyte disk. The cost differential buys you ruggedness, that extra measure of compatibility, and decent resale value should you opt for a 386 machine in 18 months. Used PCs fall into three resale-price categories: IBM and Compaq, then well-known compatibles, then mail-order machines that have minimal second-hand demand.

But the options certainly do add up. Equipped with 20- or 40-megabyte hard disks, the Deskpro 286 lists for \$3,999 or \$4,999, respectively. A 70-megabyte machine with 2 megabytes of memory, EGA monitor, the tape backup, and DOS lists for \$10,086, almost enough to single-handedly pull Houston out of its current economic slump.

Compaq's list price for the 70-megabyte disk drive is \$3,999; a solidly built CDC Wren drive of the same speed and ca-

capacity can be obtained from reputable mail-order suppliers for less than \$1,100. For \$479, PC's Limited sells a Mitsubishi-based EGA monitor that's the spitting image of the \$799 Compaq EGA monitor. You could, however, opt for an exact match—the Mitsubishi XC-1410C monitor—for just \$649. The Compaq EGA board makes sense on the Deskpro 386 because the video memory loads into 32-bit memory; here, it offers no special advantage over dozens of available third-party EGA boards.

For power users who want power solutions, the Compaq family provides plenty of clout—desktop 16-MHz 386 and 12-MHz 286 machines, a 12-MHz ghetto blaster with plasma display (the Portable III), and a supporting cast of 8086, 8088,

■ **The Compaq Deskpro 286's \$2,999 cost buys you ruggedness, that extra measure of compatibility, and decent resale value should you opt for a 386 machine in 18 months.**

and 80286 Deskpros and Portables running at slightly slower speeds, with nary a 3½-inch floppy disk in sight. Compaq thinks so much of the new Deskpro 286 that it dropped the existing 8-MHz Deskpro 286 and installed the 12-MHz version at the same list price.

While bargain mail-order speedsters attract considerable attention, there's still a vast market for machines with reputable pedigrees. Factor in the discounts available to most buyers, and the price gulf isn't so horrible, especially when you can be sure Compaq devoted all that effort to compatibility.

Which is all in the timing.



Bill Howard is an executive editor at PC Magazine.

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MAKING CONNECTIONS

Zero-Slot LANs

One of the first things that attracts users to zero-slot LANs (also called RS-232C LANs after the cabling they use) is the price: about \$100 per station. The wiring is inexpensive, too—another check in the yes column. Software that's easy to install and use is yet another strong selling factor.

Zero-slot LANs like the four reviewed here—The Knowledge Network, IDEA-share, EasyLAN, and LAN-Link—allow you to transfer files among systems and share expensive peripherals without requiring network interface cards in the networked PCs. While you generally use these systems to move files several hundred feet, this distance becomes transcontinental if you use modem connections and telephone lines.

This type of LAN is a competitor for the various

Given their inexpensive RS-232C wiring and easy-to-install-and-use software, zero-slot LANs are a tempting alternative to the expense and complexity of media-sharing LANs. Don't be tempted, however, without first assessing carefully how they'll work with your mix of machines and applications.

■ FRANK J. DERFLER, JR.

types of manual or automatic standalone printer-sharing devices (such as those compared in "Equipping Your Network: The LANstation Alternative," *PC Magazine*, Volume 6 Number 10). While such devices can compete in price with zero-slot LANs, and have less impact on the performance of the PCs in the network, the zero-slot LAN's combination of printer sharing and file exchange is hard to beat.

Also, the connections that zero-slot LANs supply can attach workstations to network gateways for infrequent queries, for entering an electronic mail system, and for using productivity-enhancement tools such as group scheduling calendars.

INSTALLATION Installing zero-slot LANs should be easy. Indeed, if you use the

■ ZERO-SLOT LANs

■ Zero-slot LANs are most valuable when used through a circuit switch to increase their flexibility and area of coverage.

RS-232C cables the vendors provide or recommend, take your time, record your steps, and read the manuals, the installation is easy (or at least logical). But if you just jump in and start plugging cables together, you're in for miles of bad connections.

A love/hate relationship with the RS-232C cabling that zero-slot LANs use is typical. Used by almost everyone and everything in the LAN industry, RS-232C cables can carry signals at up to 115K bits per second in practical installations (far above their rated speed). The signaling in the cable allows several different ways to control the flow of bits. But the differences in wiring, connectors, bps rates, parity, word length, and other technical factors form a matrix of potential garbled bits and lack of response. So, as a result, installing a zero-slot LAN calls for more hardware aptitude than installing even a token-ring media-sharing system.

PERFORMANCE Zero-slot LANs will always perform slower than LANs that use network adapter cards for two reasons. First, RS-232C is a slower signaling scheme. It isn't supposed to go any faster than 9.6K bps. Even RS-232C systems that use unorthodox programming to achieve speeds of 115K bps are operating at 11 percent of the speed of the slowest StarLAN media-sharing LAN. Of course, many stations are sharing the StarLAN wiring stations, and the RS-232C connection is dedicated, but other factors such as disk access speed work to keep the StarLAN media from being saturated. Hard disk drives transfer data more slowly (75K to 100K bps) than the slowest media-sharing LAN (1 megabit per second). But the

RS-232C network usually moves data more slowly than the transfer rate of a hard disk, so the network can slow down the throughput of the disk instead of vice versa.

Second, and even more important to performance, the network interface cards in media-sharing LANs perform many chores related to forming the data for transmission, communicating with other systems, and quickly moving data from the network to the CPU and peripherals for actions. The CPU in an RS-232C network has to do all the same jobs with little help from the single Universal Asynchronous Receiver/Transmitter chip that handles the RS-232C port. When the CPU is busy attending to network tasks, it has less time for regular applications.

In our opinion, which we feel the performance tests support, the RS-232C-based zero-slot LANs are too slow to meet the needs of users trying to access database management files for anything more than infrequent queries. If your work group multiple-station access to the same data files, we think you're better off with a faster, more flexible media-sharing LAN with dedicated network interface cards. These networks, such as StarLAN, Ethernet, or ARCnet (see "Making Connections: LANs Under NetWare," *PC Magazine*, Volume 5 Number 21), have sophisticated media-sharing and data movement protocols that give faster performance than an RS-232C system.

VALUABLE WITHIN LIMITS Zero-slot LANs are most valuable when they are used through a circuit switch, such as a PBX, to increase both their flexibility and area of coverage. With either dedicated or switched connections, they're really an excellent way to share expensive printers, plotters, screen cameras, and many other peripherals. Zero-slot LANs can also do a good job of providing file exchanges, electronic mail, and other services; unfortunately, they can't give you access to the full power of a database management system, as the faster, more-flexible media-sharing LANs can.

In addition, while zero-slot LANs are one of the least expensive ways to transfer files among systems, the rapidly falling price of StarLAN cards, which are expect-

ed to drop from about \$600 to \$200, will lower the price differential between media-sharing LANs and zero-slot LANs from its traditional ratio of 9:1 to more like 3:1 (this ratio factors in interface cards plus other costs such as networking software). At that point, the difference in performance between the media-sharing LAN and the zero-slot LAN could cause some potential zero-slot LAN buyers to consider spending the extra money for a media-sharing LAN.

APPLIED KNOWLEDGE GROUPS INC.

The Knowledge Network

The Knowledge Network sings. A product of Applied Knowledge Groups, The Knowledge Network is one of the few networks (the IBM Token-Ring Network is another) that make noises when they operate. But while the sound of the Token-Ring (see "Making Connections: The IBM Token-Ring Network," *PC Magazine*, Volume 6 Number 1) is a little click made when a station enters or leaves the network, The Knowledge Network's Node interface makes a noise that sounds like a soft but furious cricket when it operates.

Aside from its auditory qualities, The Knowledge Network is an easy-to-install



FACT FILE

The Knowledge Network
Applied Knowledge Groups Inc.
1095 E. Duane Ave., #203
Sunnyvale, CA 94086
(800) 443-1254
(800) 422-1254 (in Calif.)

List Price: Starter Kit, including manual, software, two nodes, and cable, \$299; Add-on Kit, including manual, software, one node, and cable, \$149.50.

Requires: 48K RAM (without print spooling), 64K RAM (with print spooling), DOS 2.0 or later.

In Short: An easy-to-use-and-install RS-232C-based zero-slot LAN program that can join as many as six PCs by their RS-232C ports. Not copy protected.

CIRCLE 87 ON READER SERVICE CARD

■ ZERO-SLOT LANs

RS-232C-based zero-slot LAN program. The Knowledge Network system can join as many as six PCs by their RS-232C ports. The connections between the serial ports are (obviously) unique, and the network needs no multiport cards. The PCs in The Knowledge Network can exchange files and share printers. Users access the networked facilities by using normal DOS commands and a few unique commands. Our performance tests and evaluations show that the software has a good user interface but that the network operates slowly and can get backed up.

CAPABILITIES The Knowledge Network system doesn't use a dedicated or even a designated server. Software running on every workstation is used to designate what resources in that workstation are available to the network. Any PC can share its attached printers and internal disk drives with other stations on the network. Although all the networked stations can access a shared drive, The Knowledge Network software protects files by allowing only one PC at a time to write on a drive. When you want to write to a drive, you run a special program locking everyone else out. You have to relinquish the writing capability before anyone else can write.

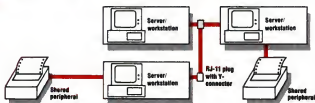
The Knowledge Network is deceiving because the software seems so simple, but it is a complex package in a plain wrapper. The CPU in any workstation on an RS-232C LAN has to do a lot of work moving data into and out of the serial ports. A separate memory partition created by the program on every station handles the communications functions. The CPU's time is divided between this partition and the regular foreground program operations. DOS commands entered in the foreground that require the use of remote network resources are automatically redirected to the background for processing through the communications channel.

VIRTUAL DISKS The concept of virtual disks is that any shared drive on the network appears to be simply another drive in the workstation. And you don't need special commands to access a networked virtual disk.

The Knowledge Network handles vir-



Applied Knowledge Groups' The Knowledge Network Bus Topology (Media: RS-232C cable)



The Knowledge Network system, which is comprised of (1) software and (2) cabling, can join as many as six PCs by their RS-232C ports. A Knowledge Network system doesn't use a dedicated server; instead, software running on every workstation is used to designate which resources in that workstation are available to the network. Any PC can share attached printers, internal disk drives, and other peripherals with other stations on the network. The wiring of The Knowledge Network is unique among RS-232C networks. In both the physical and electrical sense, The Knowledge Network is a data bus. The network uses a CSMA (carrier sense multiple access) protocol for preventing data collisions. Since the LAN uses only two wires to carry data between stations, you can connect cable with standard RJ-11 jack and telephone wire Y connectors to hook the system together.



tual disks very easily. Every workstation can display a chart showing the drives contributed to the network by each workstation. If you want the C: drive on Bill's workstation to act as your Y: drive, you move the cursor to the listing for Bill's C: drive on your screen and type Y:. This selection can be saved permanently, and

from that time on if Bill's machine is active on the network and its configuration hasn't changed, his C: drive will be your Y: drive.

The DOS commands that involve reading and copying work normally on networked drives. You can copy files from Bill's C: drive to your own A: drive by typ-

■ ZERO-SLOT LANs

ing COPY Y:filename A:. The only exception to the use of DOS commands involves writing to a drive. If you need to write to a drive, you run a program called NETACC, which has several extensions. Typing NETACC L Y: locks the drive acting as your Y: drive. To let other stations write to that drive, you must remember to type NETACC U Y: when you are done. In many cases, you can issue these commands automatically by using a batch file.

HOOKING UP The Knowledge Network's special wiring adapter Node, a reasonably normal-looking RS-232C female plug, is what makes the system sing. Instead of a hole for a cable, it has a standard RJ-11 telephone jack. Inside the hood of the cable plug, a tiny relay device rapidly multiplexes three of the traditional RS-232C signals onto a single wire in the RJ-11 jack. This rapid switching causes a sound that tells you the system is working.

The wiring of The Knowledge Network is unique among RS-232C networks. In both the physical and the electrical sense, The Knowledge Network is a data bus. The wiring can go from station to station or be brought to one point in a hub. Since the LAN uses only two wires to carry data between stations, you can use relatively inexpensive telephone cable with snap-click RJ-11 jacks to hook the system together. Telephone Y-connectors in a series of branches can connect stations. Actually, if you already have coaxial cable going between station locations (and not connected to anything else), you could use it to carry the signals generated by The Knowledge Network's "singing."

The transmission scheme used in The Knowledge Network is the same carrier sense multiple access (CSMA) listen-before-talk protocol that Ethernet and StarLAN use. Managing this scheme on an RS-232C network with its separate wires for transmission and reception must keep the software busy. Our tests seemed to demonstrate that network "hogging," the almost mythical but practically never-seen terror of CSMA networks, really exists on The Knowledge Network.

SOFTWARE INSTALLATION The Knowledge Network wins the award in the zero-slot, RS-232C LAN category for

best-looking and easiest-to-install software. Installing The Knowledge Network entails copying two programs onto the boot disk of each station and creating or modifying the CONFIG.SYS file of each station. The CONFIG.SYS file must contain a DEVICE= statement that initializes the network. Each station on the network needs a unique identifier, so you can't just copy the CONFIG.SYS from one machine to another.

As we described earlier, configuring the software consists of making a menu selection at each workstation that describes the drives to be shared with the network and which local designations will be assigned to the remote shared drives. You can save and reuse this series of selections each time the workstation is booted. The menu even has a system of help screens—another unique feature in RS-232C programs. This same menu gives a real-time picture of the stations on the network and the resources they make available.

PERFORMANCE Even good software can't overcome certain realities of physics and electronics. Jamming all those signals onto a single wire means that they all have to take their turn. Under load, The Knowledge Network does too much thinking. We were particularly puzzled by the way that using a remote printer across the network halted all other activity.

We had to modify our performance tests for this LAN, because if we included printer activity as we did with the other RS-232C networks, the times would have been meaningless. We ran the performance tests deliberately using a slow printer with no memory buffer. If a buffer is available within the printer or between the printer and the host computer, the impact of printing on network operation will be less.

When we stopped the printer and all other activity and only copied files from one machine to another, The Knowledge Network's speed was acceptable. But its performance degraded rapidly as other stations tried to pass data on the same bus. The listen-before-transmit protocol resulted in a lot of listening time on a busy network and little transmission time for each station. As with all partitioned systems,

the designers of The Knowledge Network had to decide how much of the resources to give to the LAN and how much to give to running programs. In this case they favored local operation. Our performance tests show little or no degradation in regular program operation when the network is running.

BOTTOM LINE The Knowledge Network is flexible and fun. The connection scheme allows you to use configurations wired like telephones sharing the same line instead of like those in typical RS-232C systems. But just as when people share the same line with multiple telephones, you may have to be patient and wait your turn. The Knowledge Network has good software, but perhaps the designers tried to add too much to the inherently limited RS-232C connection and signaling scheme. The system has a place in work groups in which transferred files are short and the printers have buffers, but alternative RS-232C networks, although their software may be more difficult to install or more awkward to use, can carry heavier loads.

IDEASSOCIATES INC.

IDEAshare

IDEAssociates markets two related networking products: IDEAnet and IDEAshare. IDEAnet is a traditional media-sharing network for up to 20 PCs that uses coaxial cable and network interface cards. IDEAshare is an RS-232C network for up to four stations that uses similar software.



FACT FILE

IDEAshare

IDEAssociates Inc.
29 Dunham Rd.
Billerica, MA 01821
(800) 257-5027
(617) 663-6878

List Price: \$395, including software, manual, and 50-foot cable.

Requires: 120K RAM, DOS 2.0 to 3.1.

In Short: An RS-232C network for four stations that has excellent documentation and sophisticated security, user menus, and true print job spooling. Copy protected.

CIRCLE 122 ON READER SERVICE CARD

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CIRCLE 244 ON READER SERVICE CARD

■ ZERO-SLOT LANs

Because of its close relationship to its faster software sibling, the IDEAShare software has excellent documentation and features such as security, user menus, and true print job spooling that are much more sophisticated than those usually found in RS-232C LAN software.

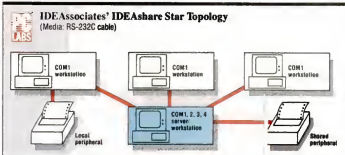
Stations on an IDEAShare system are categorized as servers or workstations. Servers have printers and disk drives that are available to the user stations. The server in the IDEAShare system can also function as a workstation when the network is operational, but workstations cannot share their own local drives and printers with the network. Normally, only three user stations are connected to a server. IDEAShare sells an adapter card providing the third serial port that is not found in typical PC-based systems. However, up to seven IDEAShare network clusters can be connected. In addition, you can connect the RS-232C-based IDEAShare system to a coax-based IDEAnet system through a communications gateway.

One feature of IDEAShare makes it easy for one or more of the user stations to call in through a modem. The program recognizes the RS-232C Carrier Detect signal that a modem generates, and it can communicate automatically with a station coming in through the modem and running the IDEAShare user station software. The server's software can also control the Data Terminal Ready RS-232C signal to initiate a modem call.

You can set disk drives on the server that are available to the network to one of three types: shared drives that can be accessed by two or more users, public drives that are open to access by all user stations, and private drives open to only one user. In addition, you can designate disk drives as read only or as read/write. Since this designation is assigned to individual users, the drive that might be read/write for one user can be read only for another.

The design of IDEAShare assumes that each person will always sign onto the network from the same station. Individual user profiles include information about the computer used as a workstation (serial and parallel ports and local disk drives) that precludes people from using their own floppy disk in just any workstation.

The IDEAShare menu system presents



IDEAShare software categorizes stations in the system as either servers or workstations. Servers have printers and disk drives that are available to the user stations. While the server can also function as a workstation, workstations cannot share their local disk drives or printers with the network. Normally, only three user stations are connected to a server, although you can link up to seven of these clusters. The system uses a standard RS-232C signaling scheme.

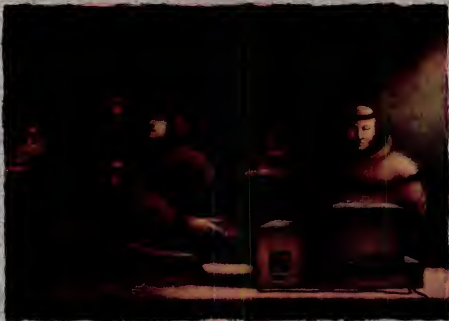


more information about the network than you can get from some highly rated media-sharing systems. The menus allow you to use special function keys to display statistical reports, exchange on-screen messages between the server and user stations, get a current listing of users and available resources, select printers, broadcast a message to every user on the network, and perform system diagnostics.

We appreciated the statistics available through the menu. The 16 statistical reports give an excellent picture of the messages being sent and received by the server or workstation. Both the 3Com and Novell network operating systems could benefit from this kind of reporting.

PRINT SPOOLING IDEAShare has an excellent print job spooling system. A series of spooling utilities, which is installed in the server, can use up to 64K bytes of the server's RAM and/or space on the hard disk. The spooling system can do tasks such as formatting a print job for 60-line pages and inserting spaces for tabs if a printer doesn't respond to the Tab function. The IDEASpool program uses several menu screens to assign printers to the spool and to change the size of the print job spool.

VIRTUAL DISKS After the system is set up, each workstation can conveniently access disk drives and printers on the net-



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From the disk conversion leader, the Shaffstall 6000 is designed to make office automation and networking more efficient than ever before.

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CIRCLE 324 ON READER SERVICE CARD

■ ZERO-SLOT LANs



Zero-Slot LANs: Summary of Features

(Products listed in ascending price order)

The features of network systems are determined largely by the networking software. For an in-depth description of the method we used to evaluate each feature, see "Making Connections: LANs Under NetWare" (PC Magazine, Volume 5 Number 21). The primary functions of zero-slot LANs are file exchanges and printer sharing. They are not as feature-rich as their pricier, media-sharing cousins.

Most of these products (The Knowledge Network is the notable exception) require that you have a detailed understanding of the resources to be shared before you start plugging things together. IDEAShare gains its high ratings from features borrowed from the IDEAnet media-sharing network. EasyLAN does not use virtual disk drives, so it is not as simple to operate as the systems that do.

| | EasyLAN Server Technology Inc. | The Knowledge Network Applied Knowledge Groups Inc. | LANLink The Software Link Inc. | IDEAShare IDEAssociates Inc. |
|-------------------------------|-----------------------------------|--|-----------------------------------|---------------------------------|
| List price | \$219.95 | \$299.00 | \$495.00 | \$595.00 |
| INSTALLATION | | | | |
| Turnkey | ● | ● | ● | ● |
| Documentation | ■ ■ ■ ■ | ■ ■ ■ ■ | ■ ■ ■ ■ | ■ ■ ■ ■ |
| NETWORK ADMINISTRATION | | | | |
| Status reporting | ■ ■ ■ ■ | ■ ■ ■ ■ | ■ ■ ■ ■ | ■ ■ ■ ■ |
| Workstation operation | ■ ■ ■ ■ | ■ ■ ■ ■ | ■ ■ ■ ■ | ■ ■ ■ ■ |
| FEATURES | | | | |
| Printer spooling/queuing | ■ ■ ■ ■ | ■ ■ ■ ■ | ■ ■ ■ ■ | ■ ■ ■ ■ |
| Peer-to-peer communications | □ | □ | □ | □ |
| Network dial-in | ● | ● | ● | ● |
| CABLE | | | | |
| No. of wires | 5 | 2* | 3 | 7 |

■ — Indicates Editor's Choice. ● — Yes □ — No
*The Knowledge Network uses two wires in a telephone-type cable to transmit data through the use of a unique node device.

Excellent — ■ ■ ■ ■
Good — ■ ■ ■ ■

Fair — ■ ■ ■
Poor — ■ ■ ■

work server as if they were local. Standard DOS calls destined for a networked drive are routed directly out of the serial port. IDEAShare also allows you to issue a command that locks a file so it can't be read or written to by another station. The commands Lock and Unlock are issued, along with the drive designator and name of the file. It is a good idea to initiate file locking and unlocking through a batch job that also starts the applications program that will use the file.

HOOING UP The designer of IDEAShare took full advantage of the handshaking available in the RS-232C signaling scheme to control communications. This means that the cable connecting the user

stations to the server needs eight wires. It must be a true null modem cable with the Transmitted Data line going to the Received Data (pins 2 and 3) line, Clear to Send going to Request to Send (pins 4 and 5), and Data Set Ready going to Data Terminal Ready (pins 20 and 6).

Connections are made by cable from the user stations' serial ports to the ports located on the server. The system is designed to operate efficiently at 38.4K bits per second over 200 feet of cable. However, if the cable picks up a lot of electrical interference, this maximum distance could actually be shorter. The available alternatives then are either to slow down transmission or reroute the cable so it is exposed to less electrical noise.

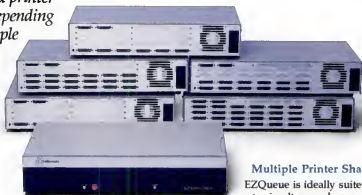
SOFTWARE INSTALLATION With networks, the number of features usually correlates directly to the effort that goes into the installation. IDEAShare proves this to be true. The system's excellent documentation greatly aids the process of installation. The manual's advice should be mandatory: make a diagram first.

When you install the IDEAShare system on each workstation, you have to run two separate programs in turn and answer the programs' configuration questions. To install the system on the server, you have to run four separate programs and answer their questions. The best way to find the answers is to have a detailed system diagram in front of you with information that includes the name of the person using the

EZQueue 3000

Peripheral Sharing Plus!

The Giltronix EZQueue™ allows up to twenty-four computers to simultaneously share one or more laser printers, dot matrix printers, or plotters. In just a few minutes, you can configure the EZQueue to efficiently manage a single shared printer or multiple printers depending on your need. Ten simple to use and expandable models are offered, each with up to two megabytes of dynamic buffering.



Increased Productivity

EZQueue goes beyond the cost advantages of sharing expensive printer resources. In a communication environment, files containing data for printing mailing labels can be directed through EZQueue to a dot matrix printer. At the same time, files containing data for letter quality output requirements can be directed to a specific laser printer containing the desired paper style. Accounting departments can share the various printer resources needed to print invoices or checks. The flexibility of EZQueue can enhance productivity and reduce total system cost in virtually any workgroup environment.

Dynamic Buffering for Simultaneous Inputs

Buffering is dynamically allocated to one or more printer queues allowing simultaneous input from each of the attached computers with no waiting. When a shared printer is busy, files are stacked up in the EZQueue's buffer and output to the designated printer when it is ready to receive the next file.

Headquarters
3780 Fabian Way
Palo Alto, CA 94303
(415) 493-1300
Telex 345542

Multiple Printer Sharing

EZQueue is ideally suited to simultaneously access and share multiple printer

resources. Each EZQueue is provided with Giltronix GX software, a DOS compatible program that makes selecting a desired printer a snap. Once installed on a computer, a few keystrokes will invoke GX from within any software program to quickly select the desired printer resource. Both serial and parallel interfaces are supported.

Simple Installation

No special cables are required because each EZQueue serial port automatically adjusts to signal directions. "Smart" ports, a "21" step installation guide and Giltronix toll-free tech support guarantee a successful installation with minimal effort.

Expandability

Unlike competitive systems, EZQueue's buffer size and number of ports can be expanded as your system grows. A minimum EZQueue starts with six serial ports, two parallel ports and 256K bytes of dynamic buffering. Serial ports can be added in six port increments up to a total of twenty-four serial ports. Buffering can be added in 256K byte increments up to a total of 2 megabytes.



Call Giltronix toll-free at (800) 531-1300
In California, call (800) 521-1330

CIRCLE 533 ON READER SERVICE CARD

■ ZERO-SLOT LANs

system, that person's permissions and limitations, the number of stations, the ports in use, the drives on each computer, and the printers used. These programs create files that are copied onto the boot disk for each station on the network.

In addition to these files, you have to create a CONFIG.SYS file. The IDEASHARE floppy disks include sample batch files for starting the system, but you might have to edit these files before you use them. Installing an IDEASHARE system takes up-front planning and attention to detail.

PERFORMANCE IDEASHARE is well behaved and relatively fast under a light load. We don't think you'll want to use the server as a workstation for anything more than casual use. The allocation of resources in the server are tilted toward network operation. The system degraded quickly when more than one workstation started to use the server.


BOTTOM LINE If you want to dedicate a computer to printer sharing, IDEASHARE has great printer control and print job spooling for you. If you want to exchange files between machines, IDEASHARE can handle single file transfers quickly. However, the time needed to install the software and the need to practically dedicate a machine to the server task raises the possibility of using a relatively inexpensive network like Fox Research's 10-NET to do the job instead.

IDEASHARE is a well-designed and full-featured system, best used in small work groups with a machine to spare as a server, in places where dialing in through a modem is important and in groups that already use the IDEANet coaxial LAN system.

SERVER TECHNOLOGY INC.

EasyLAN

Server Technology, developer of EasyLAN, was one of the first companies to introduce RS-232C zero-slot LAN software, and it has expanded its product line to include accessories such as electronic-mail and calendaring programs to work with its software. In addition, since the latest version of EasyLAN supports the NETBIOS interface, special applications can run on



EDITOR'S
CHOICE

FACT FILE

EasyLAN
Server Technology Inc.
140 Kifer Ct., Suite A
Sunnyvale, CA 94086
(800) 835-1515
(408) 738-8377

List Price: Two-PC Kit, including two sets of software, two manuals, and 30-foot cable, \$219.95; Expansion Kit, including software, manual, and one 30-foot cable, \$119.95; manual and software alone, \$99.95.

Requires: 20K RAM per satellite, hub requires total amount of RAM per satellite, DOS 2.0 or later

In Short: A zero-slot LAN that also supports the NETBIOS interface and is particularly well adapted to work through circuit-switched systems; the easiest zero-slot LAN to set up, but its resource-sharing commands are not pure DOS. Not copy protected.

CIRCLE 66 ON READER SERVICE CARD

it, such as gateways to mainframe systems that use NETBIOS to establish communications sessions between network stations.

Besides being useful for resource sharing between PCs directly connected by RS-232C cables, EasyLAN is well adapted to work through circuit-switched systems. Server Technology cooperates with Northern Telecom, SRX, Digital Products, and other circuit-switched system manufacturers to supply software offering both security and functionality for PCs connected by a circuit switch.

EasyLAN was the easiest zero-slot LAN to set up of all of those we worked with, but its resource-sharing commands are not "purely" those of DOS. The EasyLAN commands tag the letters EZ onto the most common DOS commands (for example, EZCOPY) to send them to the serial port. We didn't judge this feature to be a significant usage or training problem, however, since the commands would normally be hidden in batch files.

CAPABILITIES The EasyLAN software lets you exchange files, perform basic DOS functions, and share printers and other devices among networked computers using RS-232C connections. An EasyLAN system has no dedicated file server; any PC can share resources with any other PC. The resource-sharing software oper-

ates in the background mode, so you can run a regular applications program on your PC while someone else uses your printer or disk drive through the serial port.

While EasyLAN has no dedicated file server, one machine may serve as a hub for the RS-232C wiring, and it may have most or all of the networked printers attached to it. You can use the hub computer as a workstation. If the network has more than two PCs attached to the hub, we suggest using a hub machine that has a hard disk (for printer spooling) and an 80286 fast processor.

EasyLAN handles printer sharing smoothly. Every PC in the EasyLAN network can have three logical printer ports, even if no real ports are in the machine. Each logical port can be a printer on some other network station. Word processing programs, and other programs sending output to a printer, address a logical serial or parallel port. The EasyLAN software intercepts the print stream and sends it to the appropriate PC with a shared printer. The software queues the files for printing and sends them to the printer on a first-in, first-out basis. Since the print queue is held on a disk drive of the PC with the networked printer, the printing process is more efficient if a hard disk drive is available.

The printer-sharing system isn't fancy: it doesn't notify you of finished jobs or priorities in the print queue, but it works effectively. Up to 20 PCs can share a printer in an EasyLAN network, and each one can have a combination of virtual and actual printers.

The EasyLAN package also includes a program called *EasyTerm*, which is a simple communications program that dials a modem or a PBX line to call another station. You can make the dialing sequence automatic so that when a person using the system enters the single command, a batch file will handle all the connection steps.

VIRTUAL DISKS EasyLAN does not give the "virtual disk" service that other zero-slot LAN programs such as LANLink provide. Virtual disk programs let you use the disk drives shared by other computers on the network as one of the additional disk drives of your computer. The C: drive of one network machine might become your

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FIVE NEW MODELS

SHARE PRINTERS AND BUFFER PRINT JOBS WITH ONE VERSATILE UNIT

Print Master from BayTech is an intelligent printer controller that connects between your computers and printers. It allows you to share one printer automatically, contend for multiple printers automatically, or switch between several printers by sending a simple code, not by changing cables. Plus, Print Master's generous built-in buffer spools data until your printers can receive it.

Because Print Master is a very flexible device, you can set it up to fit your application, even if your application changes.

YOU SET UP THE IN-OUT PORTS

You configure Print Master's ports for any combination of printers and computers by answering questions from easy-to-follow menus. For example, with the ten port Print Master, nine computers can share one printer, eight computers can share two printers, seven computers can share three printers, and so on, to one computer which can share nine printers. You can also menu-select the disconnect time-out, form feeds, etc. and on serial models, the configuration of individual ports to translate for printers and computers using different configurations.



512K OR ONE MEGABYTE BUFFER KEEPS YOU WORKING INSTEAD OF WAITING

Since Print Master can accept data faster than your printer (up to 19.2KB serial or 5,000 characters per second parallel), you can send a print job to Print Master's standard 512K buffer and then go on to another project. All users connected to Print Master can send data to this common pool buffer, and they can be doing it simultaneously, even if no printer is available. Data is stored in the buffer until it can

be sent on a first-job-in-first-job-out basis to the selected printer. If you need more memory than 512K, Print Master is optionally available with one megabyte buffer.

If several users are sharing one printer, printer sharing via Print Master is completely automatic. There are no codes to send. You simply perform your normal print operation. If you are sharing several identical printers, connection is also

automatic. Again, you perform your normal print operation and are connected to the next available printer on a first-come-first-serve basis. Print Master will send data to all printers simultaneously to keep your printers running at full capacity.

If you are sharing several different printers, such as a laser-jet, a dot matrix and a plotter, and you wish to select a specific printer, you do your normal print routine and also send a printer select code (which you can define yourself) before the first characters of your data. The data is then routed to the selected printer. It's that easy.

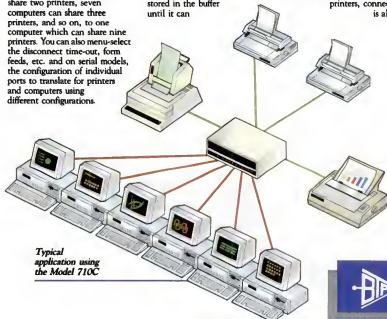
PARALLEL, RS-232C OR RS-422A MODELS

706A (6 parallel ports), \$795
706C (6 serial ports), \$795
708C (8 serial ports), \$895
710C (10 serial ports), \$995
706D (4 parallel/2 serial), \$795
708D (6 parallel/2 serial), \$895
706E (4 serial/2 parallel), \$795
708E (6 serial/2 parallel), \$895
710E (8 serial/2 parallel), \$995
708F (4 serial/4 parallel), \$895
710F (6 serial/4 parallel), \$995
All above models have standard 512K buffers.
Additional 500K buffer, \$249
RS422A for distances up to 4,000 feet now available on some models.

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Call or write BayTech at P.O. Box 387, Highway 603, Bay Saint Louis, Mississippi 39520, USA. Telex 910-333-1618. Phone 601-467-8231 or

800-523-2702



Typical
application using
the Model 710C

CIRCLE 214 ON READER SERVICE CARD



BAY TECHNICAL ASSOCIATES, INC.
DATA COMMUNICATIONS PRODUCTS



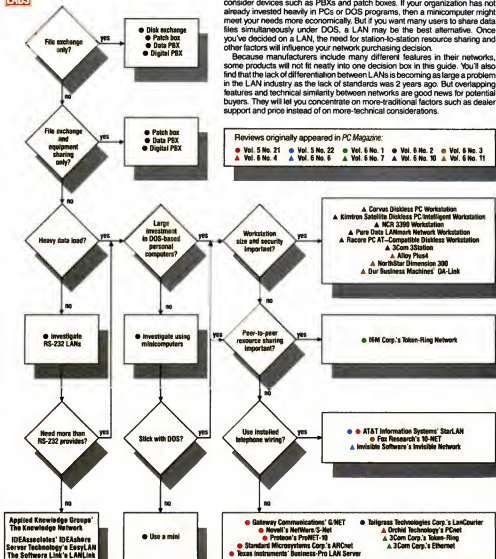
The Connectivity Decision Guide

This chart is designed to help you select from among the many information-transfer and resource-sharing alternatives. As you can see on the chart, if all you really need to do is exchange files or share printers, then you should consider devices such as PBXs and patch boxes. If your organization has not already invested heavily in PCs or DOS programs, then a minicomputer might meet your needs more economically. But if you want many users to share data files simultaneously under DOS, a LAN may be the best alternative. Once you've decided on a LAN, the need for station-to-station resource sharing and other factors will influence your network purchasing decision.

Because manufacturers include many different features in their networks, some products will not fit neatly into one decision box in this guide. You'll also find that the lack of differentiation between LANs is becoming as large a problem in the LAN industry as the lack of standards was 2 years ago. But overlapping features and technical similarity between networks are good news for potential buyers. They will let you concentrate on more-traditional factors such as dealer support and price instead of on more-technical considerations.

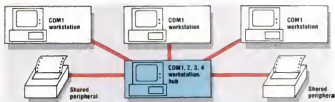
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- Vol. 5 No. 21 ● Vol. 5 No. 22 ● Vol. 6 No. 1 ● Vol. 6 No. 2 ● Vol. 6 No. 3
- ▲ Vol. 6 No. 4 ▲ Vol. 6 No. 6 ▲ Vol. 6 No. 7 ▲ Vol. 6 No. 10 ▲ Vol. 6 No. 11





Server Technology's EasyLAN Star Topology (Media: RS-232C cable)



(1) EasyLAN software requires no dedicated file server, but one machine can serve as a hub for the RS-232C wiring and can have networked printers attached to it. EasyLAN needs five wires in the RS-232C cable to carry data and signals between PCs. The system sends data in packets, with statistical checking of the packets to ensure correct delivery. In addition to COM1 and COM2, EasyLAN can support up to 18 serial ports. Server Technology markets (2) a multiport serial board with 6 ports, and you can attach three of these to a PC serving as a hub.



X: drive, and the B: drive of another machine on the network might become your Y: drive. Similarly, your C: drive can become someone else's Y:.

A virtual disk drive structure allows you to use standard DOS commands and batch files to gain access to network resources. Virtual disk drives literally make the network invisible to the person who is using the network—except for some dif-

ferences in storage size and speed.

However, a virtual disk drive structure must patch DOS to redirect disk drive commands to the appropriate port. The system administrator must write DOS batch files that name the specific directories and subdirectories the shared disk drive will use. The batch files map or direct the use of the shared disk drive through detailed naming schemes, so these

actions are normally hidden from the users of the system.

The EasyLAN network uses special commands to perform the standard DOS functions on remote disk drives. For example, the command `EZDIR PC1:C` gives a directory of the C: drive on the PC named PC1. Typing

```
EZCOPY PC2:B:DATABASE.* C:
```

copies all files named DATABASE, with any extension, from the B: drive of PC2 to the C: drive of the local machine. By hiding these commands behind batch files in much the same way that a system administrator would probably hide the commands in a system with a virtual disk architecture, you can spare inexperienced users the need to learn them.

The system's EZ commands limit the ability of this system to support database management programs using standard DOS calls to read files on a networked drive. If you need to use a database management system through a zero-slot LAN, EasyLAN is not for you.

EasyLAN allows you to prevent files from being corrupted while they are in use. You can issue the Checkout command to make a specific file unavailable to other users. The command requires you to respond to a series of questions that include the network name of the PC holding the file. These questions make using Checkout intimidating for inexperienced operators, but because questions within a program are involved you can't hide Checkout inside a batch file. Overall, this protection scheme is more difficult to use than those in other RS-232C systems.

HOOKING UP EasyLAN needs five wires in the RS-232C cable to carry data and signals between PCs. The wiring scheme uses signal lines within the RS-232C cable (handshaking) to control the flow of data. The system sends data in special packets, with statistical checking of the packets to insure correct delivery. Using this statistical cyclical redundancy check to ensure error-free data transfer is a widely accepted technique in communications systems.

EasyLAN can control the RS-232C port in IBM PCs and most clones at speeds up to 56K bits per second. The system can

We understand

- ✓ denotes IBM-AT compatibility.
 * denotes IBM-PCjr compatibility.
 CP—copy protected, NCP—not copy protected

SOFTWARE

We only carry the latest versions of products.
 Version numbers in our ads are current at press time.

| | |
|---|------|
| Alpha Software ... NCP | |
| * Keyworks 3.0 (Macros) | \$49 |
| * Alpha/Three 1.0 (DB3 file compatible) | 223 |
| American Small Business Computers | |
| * ProDesign II 2.5 (NCP, low price CAD) | 169. |
| Ansa ... NCP | |
| * Paradox 1.1 (easy-to-use database) | 419 |
| Application Techniques ... NCP | |
| * Pizazz 1.0 (see what your printer is missing) | 35 |
| Ashton-Tate ... NCP | |
| * dBase III Plus 1.1 (the standard) | call |
| * Framework II 1.1 (integrated excellence) | call |
| * Chart-Master 6.21 | 229 |
| * Rapid File 1.0 | 269 |
| * MultiMate Advantage II (new version) | call |
| Bible Research ... NCP | |
| * THE WORD 3.1 (KJV Bible on Disk) | 159 |
| * THE WORD 3.1 (NIV Bible on Disk) | 159. |
| Borland International ... NCP | |
| * Turbo Tutor 2.0 (learn Turbo Pascal) | 24. |
| * Turbo Database Toolbox 1.2 | 41. |
| * Turbo Graphix Toolbox 1.0 | 41. |
| * Numerical Methods Toolbox 1.0 | 59 |
| * Turbo Lightning 1.0 (puffer, thesaurus) | 59 |
| * Eureka 1.0 | 59 |
| * Turbo C 1.0 | 59 |
| * Turbo BASIC 1.0 | 59 |
| * Turbo Pascal 3.0 w/BCD & 8087 support | 59 |
| * Turbo Pascal w/Turbo Tutor | 75. |
| * Turbo Prolog 1.1 | 59 |
| * Turbo Prolog Toolbox 1.0 | 59 |
| * Turbo Jumbo Pack | 169. |
| * Sidekick 1.5 | 51 |
| * Traveling Sidekick 1.0 | 43. |
| * Reflex 1.1 | 87 |
| * Reflex Workshop 1.0 | 41. |
| * Superkey 1.1 | 59 |
| Breakthrough ... NCP | |
| * Timeline 2.0 (project management) | 239 |
| Broderbund ... CP | |
| * Print Shop (banners, signs, etc.) | 35 |
| * Print Shop Companion (tools for PS) | 33 |
| * Graphics Library 1 or 2 | 22. |
| Computer Associates ... NCP | |
| * Spreadsheet Auditor 3.0 (check your work) | 89. |
| * SuperCalc 4 1.1 (includes Sidekicks) | 309 |
| Core International ... NCP | |
| * Core Fast 1.0 (editors' choice) | 95. |
| Crosstalk Communications ... NCP | |
| * Crosstalk XVI 3.61 | 95. |
| * Remote 1.3 (run your PC from afar) | 95 |
| Dac Software ... NCP | |
| * Dac Easy Base | 32 |

PC Connection Software Special

through June 30, 1987

TRUE BASIC, Inc. ... NCP True BASIC 2.0

The second generation of the original BASIC is now on special. Written by John Kemeny and Thomas Kurtz (co-developers of the first BASIC programming language) True BASIC 2.0 will feel just like an old friend, while adding all the new features you've always longed for.

- Fully modular structure, with modules available to be compiled separately and stored as libraries
- Supports the full range of graphics adapters: CGA, EGA, and Hercules
- Supports 8087/80287 math co-processor, mouse, full 640k memory, string length to 64k
- Features a full editing environment, batch-like file operations, direct outputting, full path support

For the IBM PC, XT & AT. \$59.

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| * Dac Easy Payroll | 32. |
| * Dac Easy Accounting (great small pkg.) | 45. |
| Daybreak Technologies ... NCP | |
| * Silk 1.0 (advanced features) | 169. |
| Digital Research ... NCP | |
| * Gem Draw Plus 2.0 | 189 |
| Executive Systems ... NCP | |
| * XTREE 2.0 (DOS shell) | 34 |
| 5th Generation ... NCP | |
| * Fastback 5.14 (quick, reliable) | 89 |
| Generic Software ... NCP | |
| * Generic CAD 3.0 (full featured) | 69 |
| * Auto Dimensioning | 35 |
| Hilgrieve Software ... NCP | |
| * Hyper Access 3.2 | 89 |
| Harvard Associates ... NCP | |
| * PC LOGO 2.0 | 89 |
| * Hayes ... NCP | |
| * Smartcom II 2.1 | 89 |
| Infocom ... NCP | |
| * Cornerstone 5.2 (powerful database) | 59 |
| Intersecting Concepts ... NCP | |
| * Backup Master 2.0 | 59 |
| Javelin Software ... NCP | |
| * Javelin 1.0 (more than a spreadsheet) | 139 |
| Lifetree ... NCP | |
| * Volkswriter Deluxe Plus 1.0 (an old favorite) | 69 |
| * Volkswriter 3.1.0 | 147 |
| Micro Education (MECA) ... CP | |
| * Managing Your Money 3.0 | 115 |

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| Micropro ... NCP | |
| * WordStar Professional Release 4.0 | \$259. |
| * WordStar 2000 Plus Release 2 | 285. |
| Microim ... NCP | |
| * R-base System V 1.1 (with Express) | 429. |
| * R-base Graphics 1.0 | 159. |
| Microsoft ... NCP | |
| * Windows 1.03 (incl. Write & Draw) | 65. |
| * Multiplan 3.0 | 119. |
| * Chart 2.02 | 189. |
| * Word 3.11 (graphics based) | 229. |
| * Project 3.0 | 239. |
| LANGUAGES | |
| * Quick Basic 3.0 (newest version) | 59 |
| * Macro Assembler 4.0 | 97. |
| * FORTRAN Compiler 4.0 | 289. |
| * C Compiler 4.0 | 279. |
| Monogram ... NCP | |
| * Dollars & Sense 3.0 | 105 |
| Nantucket Software ... NCP | |
| * Clipper (Autumn '86, DB3 Plus compiler) | 399 |
| No!o Press ... NCP | |
| * WinWriter 1.0 | 35. |
| Paul Mace ... NCP | |
| * H/Text-H/Format 1.0 (hard-disk tools) | 49 |
| * Mace Utilities 4.0 (DOS utilities) | 59 |
| Paperback Software ... CP | |
| * VP-Planner 1.3 (1-2-3 compatible) | 57. |
| * VP-Info 1.0 | 57. |
| * VP-Expert 1.0 (expert system) | 57. |
| Personics ... NCP | |
| * SmartNotes 2.0 (Post-it-like notes) | 49. |
| * See More 1.0 | 49 |
| Quarterdeck ... NCP | |
| * DESQView 2.0 (operating environment) | 79 |
| Simon & Schuster ... NCP | |
| * Webster's New World Speller 1.3 | 39. |
| * Webster's New World Thesaurus 1.07 | 43 |
| * Webster's New World Writer 1.04 | 85. |
| Softlogic Solutions ... NCP | |
| * Double DOS 4.0 | 35 |
| * Software Carousel 2.0 (everything resident) | 35 |
| * Disk Optimizer 2.01 (speeds up HD) | 35. |
| Software Publishing ... NCP | |
| * PFS: Personal Publisher 1.0 | 89. |
| * PFS: First Choice 1.0 (integrated) | 109. |
| * PFS: Professional Write 1.0 | 119. |
| * PFS: Professional File 1.0 | 149. |
| * PFS: Professional Plan 1.0 | 149. |
| * Harvard Presentations Graphics A 02 | 239. |
| * Harvard Total Project Manager 2.0 | 349. |
| * Harvard Professional Publisher 1.0 | 409. |
| Springboard ... CP | |
| * Newsroom (make your own newspaper) | 35. |
| * Certificate Maker (NCP) | 34 |
| * Newsroom+Pro (NCP) | 79. |
| Symantec ... NCP | |
| * Q & A 2.0 (database, word processor) | 209. |
| True BASIC, Inc. ... NCP | |
| * True BASIC 2.0 | special |
| * True BASIC Libraries | each 32. |
| Turner Hall ... NCP | |
| * SQZ! 1.5 (make 1-2-3 sheets smaller) | 49. |

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| • Note-It 2.0 (notes on 1-2-3 sheets) | \$49 |
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| Unison World | |
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| • Printmaster 1.5 (CP) | 37 |
| • WordPerfect Corp. ... NCP | |
| • WordPerfect Library 1.1 | 59 |
| • WordPerfect 4.2 (one of the best) | 239 |

TRAINING

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| ATI ... CP | |
| • SKILL BUILDER PROGRAMS | |
| IBM-PC BASIC | each 33 |
| • TRAINING POWER PROGRAMS | |
| Lotus 1-2-3 Wordperfect dBase III Plus | |
| WordStar Displaywrite 3 | each 43 |
| Individual Software ... CP | |
| • The Instructor II (intro to the PC) | 26 |
| • Professor DOS | 33 |
| • Tutorial Set (both items above) | 49 |
| • Typing Instructor II | 26 |
| • Training for Lotus 1-2-3 (for vers. 1A & 2) | 37 |
| Microsoft ... NCP | |
| • Learning DOS (for any version) | 33 |
| Simon & Schuster ... NCP | |
| • Typing Tutor III 1.5 | 33 |

EDUCATIONAL

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| Berron's ... CP | |
| • Computer SAT | 35 |
| Designware ... CP | |
| • Spellcopter (ages 6 to 10, reqs. CGA) | 22 |
| Eduware ... CP | |
| • Algebra 1-2,3, or 4 (reqs. CGA) | 22 |
| Stone & Associates ... CP (reqs. CGA) | |
| • My Letters, Numbers, Words (ages 2 to 6) | 27 |
| • Kids Stuff (ages 2 to 6) | 27 |
| True BASIC, Inc. ... NCP | |
| • Calculus | 32 |
| • Pre-Calculus | 32 |
| • Trigonometry | 32 |
| • Algebra | 32 |

RECREATIONAL

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| Blue Chip ... CP | |
| • Millionaire II | 36 |
| • Managing for Success | 36 |
| Electronic Arts ... NCP | |
| • Starlight (reqs. CGA) | 32 |
| • Chessmaster 2000 (CP reqs. CGA) | 32 |
| Hayden Software ... CP | |
| • Sargon III (Chess program) | 32 |
| Infocom ... NCP | |
| Bureaucracy | Hollywood Hijinx |
| Enchanter | Hitchhiker's Guide |
| Leather Goddesses of Phobos | each 25 |
| Zork Trilogy | 49 |
| Microleague Sports ... CP | |
| • Microleague Baseball (reqs. CGA) | 25 |

PC Connection Hardware Special

through June 30, 1987

EPSON

- FX-86e
- FX-286e

The latest versions of the original workhorses from Epson, the new FX-series printers are hot. With rated speeds up to 200 cps, full Epson ESC/P and IBM ProPrinter emulations, IBM extended character set in both Epson and IBM modes, and built-in friction and tractor feeds, everybody wants one. Or two.

- Selectype Panel provides single touch selection of Draft/NLQ, Roman/Sans Serif, Normal/Condensed
- Draft mode speeds up to 240 cps, NLQ mode speeds up to 48 cps
- Built-in Epson reliability—these printers are backed by a full one year warranty, with a second year available. Also, PC Connection is an authorized Epson repair center

| | |
|------------------------|-------|
| Epson FX-86e | \$349 |
| Epson FX-286e | 479 |
| Parallel printer cable | 15 |

Microprose ... CP

- F-15 Strike Eagle (reqs. CGA) 22 |- Silent Service (reqs. CGA) 22 |

Microsoft ... CP

- Flight Simulator 2.13 (reqs. graphics brd.) 32 |

Mindscape ... CP

- Balance of Power (reqs. graphics brd.) 30 |

1Step Software ... CP (reqs. CGA)

- Golf's Best (Pinehurst or St. Andrew's) 19 |

Parlor Software ... CP

- Bridge Parlor (best Bridge simulation) 49 |

Sierra On-Line ... CP

- Space Quest (reqs. CGA) 33 |

King's Quest III (reqs. CGA)

- King's Quest III (reqs. CGA) 33 |

Simon & Schuster ... CP

- Star Trek/Prometheus Prophecy 27 |

Spectrum HoloByte ... NCP

- Orbiter (Shuttle simulation, reqs. CGA) 27 |

Sublogic ... CP

- Jet (reqs. graphics brd.) 33 |

XOR ... NCP

- NXL Challenge 79 |

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375M

HARDWARE

Manufacturer's standard limited warranty period is listed after each company name. Some products in their line may have different warranty periods.

AST Research ... 2 years

All boards listed (except Piggyback) include a FREE copy of DESView

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|---|-------|
| I/O Mini 2 C/S/P | \$129 |
| SxPakPlus 64k C/S/P | 169 |
| SxPakPlus 384k C/S/P (fully populated) | 209 |
| SxPakPremium 256k C/S/P | |
| (upgrades to 1 Mb or 2 Mb w/Piggyback) | call |
| SxPakPremium Piggyback Board 256k | 189 |
| • Advantage Premium 512k S/P | |
| (upgrades to 1 Mb or 2 Mb w/Piggyback) | call |
| • Advantage Premium Piggyback 512k | 289 |
| RAMPage! 256k (upgrades to 2Mb) | call |
| RAMPage! 286 512k (upgrades to 2Mb) | call |
| AST Premium series boards and RAMPage! boards support EMS and fully support EEMS. | |

Amdek ... 2 years

- Video 310A Amber monochrome monitor 159 |- Video 410A Amber monochrome monitor 169 |- Color 722 (EGA compatible) 499 |

CompuCase ... lifetime

- Smartmodem-to-AT cable (9 feet) 19 |- 15-foot Parallel Printer cable 27 |- 2-Position (AB switch box, 2 yr warranty) 39 |- 3-Position (ABC switch box, 2 yr warranty) 65 |

Cuesta ... 1 year

- Datasaver 400 Watt (backup power unit) 499 |

Curtis ... lifetime

- ACCESSORIES |

- Printer Stand 18 |

- Universal System Stand 25 |

CABLES

- Smartmodem-to-PC Cable (9 feet) 17 |

- Keyboard Extension Cable (3 to 9 feet) 27 |

- Extension Cables for IBM Mono Display 33 |

- Printer-to-IBM cable (9 feet) 17 |

SURGE SUPPRESSORS

- Safe Bloc (6 outlets, 1 yr warranty) 15 |

- Diamond Chip (phone line only, 1 yr warranty) 15 |

- Safeship (6 outlets) 21 |

- Diamond (6 outlets) 29 |

- Diamond-Plus (w/FAX & modem protection) 41 |

- Emerald (6 outlets, 6 ft cord) 36 |

- Ruby (6 outlets, EMV/FI filtered, 6 ft cord) 55 |

- Ruby-Plus (w/FAX & modem protection) 65 |

DCA ... 1 year

- Irma (3270 emulation board) 729 |

Epson ... 1 year

- EX-800 printer (80 col., 300 cps) 409 |

- EX-1000 printer (136 col., 300 cps) 539 |

- FX-86e printer (80 col., 200 cps) special |

- FX-286e (136 col., 200 cps) special |

- LQ-800 printer (80 col., 180 cps) 479 |

- LQ-1000 printer (136 col., 180 cps) 669 |

- LQ-2500 printer (136 col., 324 cps) 939 |

- Printer-to-IBM cable (6 feet) 15 |

For the IBM-PC (XT & AT) Exclusively.

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800/243-8088.

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| Everex ... 1 year | |
| Evercom II 1200 Internal Modem | \$119 |
| Evercom II 2400 Internal Modem | 199 |
| 5th Generation ... 6 months | |
| Logical Connection 256k | call |
| Hayes ... 2 years | |
| Smartmodem 1200 | call |
| Smartmodem 1200B (w/Smartcom II) | call |
| Smartmodem 1200B (no software) | call |
| Smartmodem 2400 | call |
| Smartmodem 2400B (w/Smartcom II) | call |
| Hercules ... 2 years | |
| Hercules Graphics Card Plus | 189 |
| Hercules Incolor Card (incl. RAMfont) | call |
| Intel ... 5 years | |
| Above Board PC 64k (upgrades to 2 Meg) | 239 |
| Above Board PS-PC 64k C/S/P | 259 |
| Inboard 386/AT (req. cable) | call |
| Aboveboard 286 512k (for AT, XT/286) | 439 |
| Aboveboard PS/286 512k S/P (for AT, XT/286) | 469 |
| 8087 (for IBM-PC & XT) | 114 |
| 80287 (for IBM-PC AT & XT/286) | 195 |
| 80287-8 (for 8 MHz AT compatibles) | 249 |
| Kensington Microware ... 1 year | |
| Masterpiece | 94 |
| Masterpiece Remote | 119 |
| Masterpiece Plus | 129 |
| Printer stand | 17 |
| keytronic ... 90 days | |
| 5151 keyboard (cable) | 169 |
| Kraft ... 1 year | |
| 3 Button Joystick | 33 |
| Microsoft ... 1 year | |
| Bus Mouse 6.0 (w/Show Partner) | 119 |
| Serial Mouse 6.0 (w/Show Partner) | 129 |
| Mach 10 (includes Windows and mouse) | 369 |
| Migent ... 1 year | |
| Pocket Modem ext. 1200 baud, w/software | 169 |
| Mouse Systems ... lifetime | |
| PC Mouse (with Pop-up Menu software) | 99 |
| Bus Mouse (with Pop-up Menu software) | 109 |
| PC Paint Plus 2.0 | 57 |
| NEC ... 2 years | |
| Multisync monitor (EGA compatible) | 589 |
| GB-1 (supports 640 x 480 res.) | 349 |
| NSI Logic ... 3 years | |
| Smart EGA | 299 |
| Orchid Technologies ... 2 years | |
| Tiny Turbo 286 | call |
| PC Turbo 286e w/1 Meg | call |
| Turbo EGA | call |
| Jet 386 | 869 |
| Practical Peripherals ... 5 years | |
| Microbuffer Mini (parallel print buffer w/28k) | 79 |
| Microbuffer Inline (par. print buffer w/256k) | 149 |
| Princeton Graphics ... 1 year | |
| MAX-12E Amber monochrome monitor | 179 |
| HX-12E (EGA compatible) | 539 |
| SMART ... 30-day money-back guarantee | |
| PC Document Keyboard Templates | |
| DOC/Basic 3.0-3.1 WordStar | |
| Lotus 1-2-3 WordStar 2000 | |

| | |
|---|------------|
| Symphony | |
| dBase III | |
| MultiMate | |
| WordPerfect | each \$12. |
| Toshiba ... 1 year | |
| P321 SL printer (80 col., 216 cps, includes tractor) | 549 |
| P351 S/P printer Mod 2 (136 col., 288 cps) | 939 |
| Toshiba T1100 PLUS Laptop Computer | call |
| Toshiba T3100 Laptop Computer | call |
| Tseng Labs ... 1 year | |
| EVA 480 (supports 640x480 res., includes Dr. Halo II & drivers for Autocad & Lotus 1-2-3) | 349 |
| Video 7 ... 2 years | |
| VEGA Deluxe (supports 640x480) | 359. |

DRIVES

| | |
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| Control Data Corp. ... 1 year | |
| 70 Meg (formatted capacity) Int. Hard Drive for IBM AT (w/When Manager II software, 28 ms) | 997. |
| IOEMGA ... 1 year | |
| Bernoulli Box 20 Meg w/PC2 card | 1549. |
| 10 Meg cartridge | 57 |
| Bernoulli Box 40 Meg w/PC2 card | 1949. |
| 20 Meg cartridge | 79. |
| PC2B (Bootable) Card | 229. |
| Bernoulli Box Care Kit | 79. |
| Mountain Computer ... 1 year | |
| Drive Card 20 Meg (80 ms) | 499 |
| Drive Card 30 Meg (78 ms) | 589. |
| Seagate ... 1 year | |
| FREE PCTV [®] Hard Drive Installation Tape with the purchase of either of the following Seagate drives for the IBM PC only (not for AT). Specify Beta or VHS. | |
| 20 Meg Internal Hard Drive (w/Western Digital controller and cables, 65 ms) | 369. |
| 30 Meg Internal Hard Drive (w/Adaptec RLL controller and cables, 65 ms) | 399. |
| AT 30 Meg Internal Hard Drive (w/cables & instructions, 39 ms) | 589. |
| TEAC ... 1 year | |
| PC, XT 360k Drive (5 1/4" half-height) | 109. |
| Toshiba ... 1 year | |
| PC, XT 360k Drive (5 1/4" half-height) | 109. |
| AT 360k Drive (5 1/4" half-height) | 117. |
| Miniscribe Corp. ... 1 year | |
| Scitex Card 20 Meg (68 ms) | 459. |
| Scitex Card 30 Meg (68 ms) | 479. |

MEMORY

| | |
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| 64k Upgrade Set (150 ns, set of 9) | call |
| 256k Upgrade Set (150 ns, set of 9) | call |

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375M

DISKS

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| All disks have a lifetime warranty. | |
| DS/DD Disks for the PC & XT (40 TPI). | |
| Fujii MD22 (10 disks per box) | \$12 |
| Verbatim Datafile (10 disks per box) | 15. |
| Maxell MD-2 (10 disks per box) | 15. |
| DS/High Density Disks for the AT (96 TPI). | |
| Fujii (10 disks per box) | 24 |
| Verbatim (10 disks per box) | 27 |
| Maxell (10 disks per box) | 27 |
| 3 1/2" Double-sided Diskettes (720k) | |
| Sony (10 disks per box) | 23 |
| Maxell (10 disks per box) | 23 |

MISCELLANEOUS

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|---|-----|
| Compuserve Information Service (includes subscription, manual, \$25 usage credit, monthly publication) | 24. |
| Dow Jones Membership Kit | 24. |
| Innovative Concepts | |
| Flip n' File 50 (holds 50 disks) | 16 |
| Flip Sort (holds 70 disks) | 15 |
| PC Connection | |
| Computer Toolkit (all the tools you need to go with your PC in a software style binder) | 29 |

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- All U.S. shipments insured, no additional charge
- APO/FPO orders usually shipped 1st Class Mail
- Allow 1 week for personal and company checks to clear
- UPS Next Day Air available
- COD max: \$1000. Cash or certified check
- 120 day limited warranty on all products.
- To order, call us anytime Monday thru Friday 9:00 to 9:00, or Saturday 9:00 to 5:30. You can call our business offices at 603/446-3383 Monday through Friday 9:00 to 5:30

SHIPPING

- Note:** Accounts on net terms pay actual shipping
- Continental U.S.:**
- For monitors, printers, and drives, add 2% for UPS ground. Call for UPS 2nd Day & Next Day Air.
 - For computers, pay actual charges. Call for UPS 2nd Day & Next Day Air.
 - For all other items, add \$2 per order to cover UPS Shipping. For such items, we automatically use UPS 2nd Day Air at no extra charge if you are more than 2 days from us by UPS ground.
- Hawaii:**
- For monitors, printers, and drives, actual UPS Blue charge will be added. For all other items, add \$2 per order.
- Alaska and outside Continental US:**
- Call 603/446-3383 for information.

For the IBM-PC (XT & AT) Exclusively.

PC CONNECTION[®]

* DEFECTIVE SOFTWARE: REPLACED IMMEDIATELY. DEFECTIVE HARDWARE: REPLACED OR REPAIRED AT OUR DISCRETION. SOME ITEMS HAVE MANUFACTURER'S WARRANTY UP TO FIVE YEARS.



PC Power.

Sparks will fly!

There's nothing like a bolt out of the blue to put a bolt into your Blue. But the one thing you don't need is a hair-raising experience. That's why high-powered micro users turn to the thunderstruck town of Marlow, NH (pop. 546) for all their add-on and software requirements.

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Bytes make right.

You want more speed? More drive? More RAM tough power? You want to

blow the ports off your PC? Talk to the people who gave brute force a good name. We'll electrify your CPU, run rings around your resolution, and manhandle mountains of memory into your micro.

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Expose your next bright ideas with the flashy PC Connection Light. Comes with different colored lenses, flood-to-spot focusing and more. Offer not available to net accounts. Limit one per customer.

Lighten up!

As any politician will tell you, if you want power, you first must acquire an other-worldly glow (or at least a good tan). Well, there's an easier way to light up your life — just tune in and turn on your PC Connection micro flashlight. It's free to anyone who places an order of \$750 or more between now and June 30.

Just call 1-800/243-8088 or 1-603/446-3383, M-F 9:00 to 9:00; Saturday to 5:30. If you're planning to visit, call ahead to make sure what you want is in stock.

For the IBM-PC (XT & AT) exclusively.

PC CONNECTION

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■ ZERO-SLOT LANs

increase speed in standard steps from 300 baud to 56K bits per second (the terms *baud* and *bits per second* are literally interchangeable, with the 8-bit word lengths PCs usually use), with 19.2K bps being the most commonly used rate to exchange data through circuit-switched equipment.

Besides COM1 and COM2, EasyLAN supports up to 18 serial ports. Server Technology markets a multiport serial board with six ports. You can install three of these boards in a PC serving as a hub.

In a system with multiple ports, you can run different ports at different speeds. Depending on the electrical environment and the length of the cable, it might not be possible to use some connections above 9,600 bps. Other runs might operate well at much higher speeds. The ability to set different port speeds allows you to use each connection to its best advantage.

The wiring and connections needed to make EasyLAN operational are not difficult to install—if you take care to use null modem cables that connect the output line of one PC's RS-232C port to the input line of the machines to which it is connected.

SOFTWARE INSTALLATION EasyLAN provides a quick installation program that lets you get the network operational in just a few minutes. However, a separate package called the Network Configuration Program is used to adjust network parameters such as the bps rate of specific ports and other communications parameters. The configuration program is menu driven, and changing a parameter involves putting the cursor on the item to be changed and scrolling through the alternatives.

The software lets you set pass words for each device on the network. All the printers and disk drives are not likely to have to be password protected, but those devices needing protection can have it.

If you intend to set up an EasyLAN system, you should know how to use DOS batch files—not so much to get the system operating, but to get people to use it. Batch files can simplify the long commands needed to get some things done through the network.

PERFORMANCE When you divide the computing power of a PC between acting as a workstation and controlling a net-

work, neither job will be done as quickly as it would if it had had the full resources of the system. The designer and/or the installer of the system must decide if the network or the local workstation will be given more computing resources. The designers of EasyLAN decided that workstation operation is the primary task and that networking should have a minimal effect on the operation of an application. Because of this decision, EasyLAN is far from being the fastest zero-slot LAN we tested, but its operation has very little impact on the ability of the workstations to process spreadsheets and other applications.

In addition, EasyLAN is cast-iron reliable. The software either makes the connection or gives you an intelligible error message.

BOTTOM LINE The future path for EasyLAN is through circuit switches. If you want to be able to connect hundreds of PCs through your PBX or a dozen PCs through a circuit switch like Net Commander, EasyLAN is the zero-slot LAN you want. But if you plan to use only direct dedicated RS-232C connections and you want virtual disk service, then one of the other products will serve you well.

THE SOFTWARE LINK INC.

LANLink

LANLink is a product of The Software Link, in Atlanta, which has a record of creating aggressive and innovative products. The company has two related RS-232C networking systems that operate at high speed: LANLink, the subject of this review, and MultiLink Advanced.

The MultiLink Advanced software has a slightly different concept from the products we are reviewing here. It lets dumb terminals share the power of a single processor in a computer acting as a host. The dumb terminals use RS-232C connections to the main system, and they share its processor and memory. You can combine MultiLink Advanced with LANLink to make an integrated system of PCs and dumb terminals all sharing data files through RS-232C connectivity. The software also supports the NETBIOS interface for gateway programs and other network services that use NETBIOS.

The LANLink software provides fast file transfers, peripheral sharing, and even access to the same data files. We experienced problems with the program in some data transfer situations encountered during our performance tests. These problems were cured with a patch provided by The Software Link.

CAPABILITIES In its usual form, the LANLink software configures one computer as a server and other machines as workstations or, as they are called in the LANLink manual, "satellites." The server becomes the hub of a star, and all the other satellite machines connect to it by direct RS-232C cables. The satellite stations use the disk drives and printer attached to the server, and users can share only the server's resources on the network.

The latest version of the program gives all stations the optional ability to act simultaneously as servers and workstations. In addition, you can change the physical topology of the network to a bus with cables running from the COM1 port of the first machine to the COM1 port of the second machine, and from COM2 of the second machine to COM1 of the third, and so on. Despite the lack of a direct connection, any machine in the chain can use the resources of any other machine by passing the data in and out of the serial ports of the machines in between.

In this bus configuration, each machine's processor time and memory access



FACT FILE

LANLink

The Software Link Inc.
3577 Parkway Ln.
Atlanta, GA 30092
(404) 498-4465

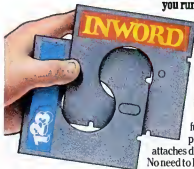
List Price: \$495, including software, manual, and cabling for one nondedicated server and one workstation; \$99 for software and manual for each additional workstation.

Requires: 128K RAM, DOS 1.0 or later.
In Short: A fast RS-232C LAN that lets 16 users share files and peripherals; the latest version also adds multitasking capability in the machine running as a LANLink server. Not copy protected.

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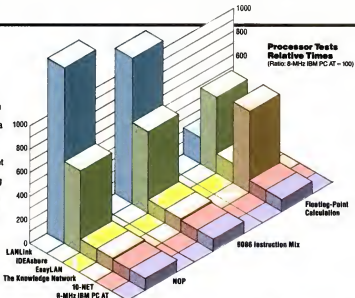
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■ ZERO-SLOT LANs



Zero-Slot LANs

The results of the processor tests when run simultaneously with the file transfer tests clearly show that it is difficult for a PC to do both jobs well at the same time. For instance, if you tried to use the AT server running our network load as a workstation under LANLink, you would get 20 percent of the performance of a 4.77-MHz PC in some tasks. Machines serving the network running EasyLAN and The Knowledge Network software would give you better-than-PC and almost-AT levels of performance as workstations, but their network performance would be less spectacular.



Performance Times (Times given in seconds)

System/Manufacturer

| | NETWORK PERFORMANCE TESTS | | | | PROCESSOR BENCHMARK TESTS | | |
|---|------------------------------|---|----------------------------|---|---------------------------|-------|----------------------------|
| | Single-Station File Transfer | Single-Station File Transfer Plus Print Job | Dual-Station File Transfer | Dual-Station File Transfer Plus Print Job | 8086 Instruction Mix | WOP | Floating-Point Calculation |
| LANLink/The Software Link Inc. | 167 | 249 | 369 | 369 | 57.1 | 107.5 | 78.2 |
| IDEAShare/IDEAssociates Inc. | 280 | 590* | 596* | 596* | 28.4 | 62.2 | 229.2 |
| EasyLAN Server Technology Inc. | 624 | 670 | 682 | 682 | 4.7 | 9.9 | 58.0 |
| The Knowledge Network/Applied Knowledge Groups Inc. | 452 | N/A | 1,000† | 1,000† | 4.6 | 9.9 | 242.7 |
| 10-NET/Fox Research Inc.‡ | 42 | 45 | 80 | 80 | 4.2 | 9.0 | 35.4 |
| 8-MHz IBM PC AT/IBM Corp. | | | | | 4.1 | 9.0 | 35.4 |

N/A—Not applicable: The Knowledge Network gave priority to the print job and would not complete the file transfer until the print job was completed.

* The DOS COPY command timed out numerous times during the file transfer, and the Re-Try alternative had to be selected to continue work.

† We ran this test on The Knowledge Network without the system printer. The DOS COPY command timed out numerous times during the file transfer, and the Re-Try alternative had to be selected to continue work.

‡ The 10-NET software was tested with a 10-NET interface card. All workstations on the network also acted as servers for shared resources on the network.

Although it is technically possible to use some zero-slot LANs to access files through a database, the most common use of these systems is to exchange files and to use shared printers. Therefore, we ran network performance tests emulating these file exchange and printer-sharing tasks. These tests are similar to our Network Speed Under Contention and Network Plus Server Cruncher tests that we used previously to test media-sharing LANs, but they are not directly comparable. These tests have been shortened to keep their elapsed times manageable, since media-sharing LANs are roughly ten times faster than zero-slot LANs. We did not run a version of the Smart Applications test, however, since that test simulates heavy access to a database management system.

To provide some comparison between media-shared and zero-slot LANs, we also ran the zero-slot LAN file transfer and printer-sharing tests on the 10-NET local area network from Fox Research. 10-Net is one of the lowest-priced media-shared LAN alternatives, and it represents a natural step up from the RS-232C-type systems.

The Single-Station File Transfer test consists of moving 12 files totaling 360K bytes from a RAMdisk on an IBM PC AT computer (8 MHz) acting as the server to a RAMdisk on a standard PC (4.77 MHz) acting as the workstation. The

timing tests are performed on the workstation. This use of RAMdisks eliminates electromechanical vagaries and gives a clear measure of how the networking software handles the RS-232C signaling system. A batch file is used to run each file transfer sequence twice. The times, therefore, are about double what it would take to copy an entire floppy disk through the network.

The Single-Station File Transfer Plus Print Job test consists of one station's sending a long text file to the printer. The timing tests are performed on the workstation. The printer used is an Epson MX-80 with no memory built-in. Actual installations could use a buffer in the printer or in a separate device to hold the print jobs, but this test places a constant printing load on the print server to see what effect this has on the file transfer activity.

The Dual-Station File Transfer Plus Print Job test is identical to the test above but adds an additional workstation sending the text file to the printer. This test represents a typical office load. The test also shows the degradation that occurs when additional stations are added to the network.

The balance struck between dedicating the resources of a computer to the network functions and to local workstation use is important. This balance determines whether a com-

puter must be used as a dedicated server or whether you can use it as a dual-purpose server/workstation. To demonstrate the effect that LAN activities have on the use of a server as a workstation, we ran the PC Labs processor benchmark tests on the AT server while it was answering file transfer requests from two workstations. The processor tests run were as follows:

The NOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. The test executes almost nothing but NOP ("No Operation") machine code instructions in a big 120K loop.

The 8086 Instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction code. These instructions are a subset of the total processor instruction set.

The Floating-Point Calculation benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with the Microsoft C Compiler 4.0.

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■ ZERO-SLOT LANs

is segmented into two partitions. Each partition is, in effect, its own computer. The LANLink package comes with two floppy disks, one for the satellite and one for the server. You can run one satellite off one dedicated server with one LANLink package. If you give server and satellite capabilities to every machine, you'll need a separate \$495 package for every machine. Software for each additional satellite retails for \$99, and each server program alone retails for \$400.

As our performance tests show, LANLink uses a lot of the workstation's resources for the network. While we did not test this bus configuration, acting as a server and as a relay would put a strain on the resources of a standard PC. The performance of a string of fast 80286-based machines would depend completely on the type of network use and local processing the machines were engaged in.

We tested the LANLink system using one machine as a server/workstation and the other machines as satellites. We believe this configuration is more typical of the way most people will use LANLink.

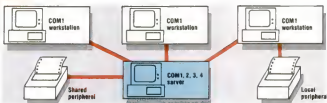
VIRTUAL DISKS The operator of a LANLink satellite station uses the disk drives of other network stations as if they were local drives. The disk drives of other stations are designated by the letter of the next available logical drive. If you have a

In its usual form, (1) the LANLink software configures one computer as a server and other machines as workstations. A LANLink server can use up to 16 RS-232C ports, which are installed with (2) special interface cards containing multiple connections. All of the workstations connect to the server directly via RS-232C cables. The workstations use the disk drives and printer attached to the server, and users can share resources only on the server.

You also have the option of configuring all stations to act simultaneously as servers and workstations. And you can change the physical topology of the network to a bus with cables running from the COM1 port of the first machine to the COM1 port of the second, from COM2 of the second to COM1 of the third, and so on. Any machine in this configuration can use the resources of any other by passing the data in and out of the serial ports of the machines in between. Both topologies use the standard RS-232C signaling scheme.



The Software Link's LANLink Star Topology
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The Software Link's LANLink Bus Topology
(Media: RS-232C cable)



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■ ZERO-SLOT LANs

PC-XT with drives A:, B:, and C: installed, the hard disk on the LANLink server becomes drive D:. The remote disk drive responds to DOS commands, and applications programs can use it just like a local drive. When a satellite is using the server's disk, a cursor flickers in the upper-right-hand corner of the screen.

To redirect appropriate DOS commands out the RS-232C port and to recognize responses through that port, you must modify the operating system of the satellite station. You do so in the LANLink program by installing a number of DOS "devices" through the CONFIG.SYS file at start-up time. A separate DOS device is installed for every server disk the satellite will use.

Virtual disk capability is found in media-sharing LANs such as those using Novell or 3Com software, but it is not available in some RS-232C networking programs. One primary reason it isn't available is that these RS-232C systems are often too slow to give a reasonably timely response to the application. LANLink's designers try to get around this limitation by running the network at speeds up to 115.2K bits per second. They do this through programming techniques that jam every possible bit through the communications channel.

HOOING UP A LANLink system uses only three wires to connect the server to the satellite. These wires carry the data flowing in each direction and the grounding for the signals. The stations on a LANLink system don't make use of the handshaking available on RS-232C circuits for signal control. This arrangement allows the network to achieve high speed and to use relatively low-cost wiring. A chart in the LANLink manual shows that 115.2K bits per second can be run over cables 50 feet in length, but this distance and speed equation is limited by the amount of electrical noise picked up by the cables.

A LANLink server can use up to 16 RS-232C ports. The added ports are installed with special interface cards containing multiple connections. All the connections between the server and the satellites are made with null modem cables that connect the output data line of one system to the input line of the other system.



EDITOR'S CHOICE

• EasyLAN

Server Technology's EasyLAN reliably does what a zero-slot LAN should do: file transfers and printer sharing. You should not have to dedicate a machine as a server on this system, and EasyLAN's speed, without a dedicated server, is adequate for appropriate zero-slot LAN applications. EasyLAN is reliable and presents understandable error messages when problems occur with the connection. It isn't real fancy, but it works well.

SOFTWARE INSTALLATION A PC running under DOS normally uses all its memory for one task at a time. It can't calculate spreadsheets and sort a mailing list simultaneously. LANLink works by dividing the computer's memory into partitions and by slicing the computer's processing time among different tasks done in series in the memory partitions. You can create up to 16 background partitions in the server to run programs controlling the communications ports.

The steps needed to install LANLink are not difficult, but they are detailed. LANLink is really a series of programs, each performing separate jobs but working with each other. When you start the system, special batch files must properly initialize and configure each program.

The biggest part of the system installation job is writing the AUTOEXEC.BAT files for each partition. We found that the installation job was simplified if everything was laid out on a piece of paper first, with some diagrams to follow and the configurations of each machine listed.

The programs running on the server include MLSlice, which sets up time-slicing in the server so that each background partition (satellite station) and foreground partition (the server's console) is given a piece of the computer's processing time; MLink, which creates 32K-byte memory partitions in the server to run the LANServe program

that controls and communicates with the satellite; LANServe, the communications program that, running in each background partition on the server (a copy in each partition), recognizes a specific satellite, makes the server's resources available, and controls the server's communications port for that satellite.

MLink takes 24K bytes to run and each of the up to 16 satellite partitions takes 32K. The foreground partition gets whatever memory is left after the background memory is assigned.

The server's normal AUTOEXEC.BAT file calls the MLSlice and MLink programs with various extensions that set the size of the partitions and other factors. You must create a separate AUTOEXEC.BAT file for each memory partition, configured for the particular satellite station that plugs into the port that the LANServe program in this partition controls.

On the satellite side, modifying the satellite's CONFIG.SYS to include the DOS DEVICE drivers is the first installation step. Then you must create an AUTOEXEC.BAT file, with any extension, calling up a program called LANsat that controls the serial port in use and its speed, the designations of the printer port and disk drive that will be routed to the server, and other parameters. This AUTOEXEC.BAT file must be customized for each satellite workstation.

PERFORMANCE As our performance tests show, for an RS-232C LAN, LANLink is very fast. File transfers go quickly, and text files move to printers faster than they can usually be printed. However, there are two drawbacks to LANLink's speed.

First, to get the Universal Asynchronous Receiver Transmitter (UART) chip, which controls the RS-232C communications, to run at a high rate of speed, the program suspends the interrupts in the computer and polls the UART looking for data. This technique is efficient, but it is also like walking a tightwire without a net.

Several times, file exchanges froze for unexplained reasons during our performance tests. These freezes usually took place when the file exchanges were under the control of a DOS batch file. They were puzzling because the system worked fine

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■ ZERO-SLOT LANs

at 19.2K bps and faster, but it froze when slowed to the more commonly used rate of 9,600 bps. We suspect the extended suspension of interrupts caused the problem. The Software Link helped us cure the problem with a patch downloaded from its bulletin board, but we never got a good explanation of what was going on.

In other earlier tests, when an intervening circuit switch inserted a few characters, a PC clone froze, displaying a divide by zero error, and a standard IBM PC rebooted itself. These events took place under somewhat experimental conditions, but they show what can happen when you run hardware "wide open."

The second major drawback to speeding up the LAN is that it slows down the workstation. Our performance tests clearly show that the local operation of a LAN-LINK server is significantly slower than that of other systems. When you divide the resources of a computer, not all jobs can be done as well as they would be on a dedicated system.

BOTTOM LINE The best application of LANLink is in small work groups with short cable runs. The program provides fast file transfers for computers connected by RS-232C cables. Its printer-sharing system isn't fancy, but it works well, and if the printer isn't busy, there is little delay for anything but the fastest laser printing jobs. Setting up the program isn't difficult, but installation is a detailed task, and if the computers or cables are rearranged, you have to modify batch files. Once the installation is complete, the system users rely on normal DOS commands.

LANLink's use of only three wires for data exchange means that you can use simple telephone cable and RJ-11 telephone jacks to connect systems running under the network. Yet it also means that the communications port runs without the typical hardware controls that keep transmissions orderly. We experienced problems with file transfers under certain conditions, but you can overcome them with a little initial experimentation, and LANLink systems typically run reliably once they're operational.

Frank J. Derfler, Jr., is a contributing editor of PC Magazine.

Think You Need an AT?

Think Again.

TABLE OF BENCHMARK RESULTS

This table shows the results of the processor/coprocessor speed tests using the April 1986 release of PC Magazine's 'PC Labs Benchmark Tests'. These are public domain programs, and are available on diskette

from PC Magazine, or via the PC Magazine bulletin board. These results were obtained by us at PCSCG, and are not yet official published PC Magazine figures.

The last line in the table, the

Norton System Information Test, is not from PC Magazine, but is part of the popular 'Norton Utilities.' The version we used was 3.1, which is the latest version but may not give identical results to older versions.

| | IBM PC | IBM AT | BREAKTHRU 286 | |
|-------------------------------------|--------|--------|---------------|------|
| Clock speed in MHz (IBM PC is 4.77) | 4.77 | 6 | 8 | 12 |
| Empty Loop | 1 | 1.99 | 3.34 | 5.15 |
| Integer add from memory | 1 | 3.35 | 4.41 | 6.02 |
| Integer multiply from memory | 1 | 6.06 | 6.55 | 8.3 |
| Floating point without coprocessor | 1 | 3.33 | 4.42 | 5.76 |
| Prime number test | 1 | 1.95 | 2.85 | 3.7 |
| Lotus 123 macro (640K) | 1 | 2.64 | 3.69 | 4.62 |
| Lotus 123 macro (256K) | 1 | 1.77 | 3.54 | 4.38 |
| Norton System Information Test | 1 | 5.73 | 7.34 | 10.2 |

In every case but clock speed the numbers indicate how many times faster a test is performed than on a regular IBM PC.

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We are excited about our three speedup products. You probably know about our Lightning disk access speedup software that was awarded PC magazine's Best of 1986 award (see box). After the smashing success of Lightning, we developed the Breakthru 286 board to be literally the most advanced, fastest, most feature-rich board available. Now we go ourselves one better with the Breakthru 286-12. This new board has the clock speed cranked up from 8 to 12MHz for speeds up to 10.2 times faster than an IBM PC.

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Turn back for
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Second, it is advanced. The BREAKTHRU 286 replaces the CPU of the PC or XT with an 80286 microprocessor that is faster than the one found in the AT. You have your choice of 8MHz at \$395 or 12 MHz at \$595. You can plug in an optional 80287 math coprocessor chip

for numeric intensive applications. A 16K cache memory provides zero-wait-access to the most recently used code and data. Look at the benchmark tests box to see how our two boards compare with the PC and the AT. Speed is addictive. You'll never want to go back to slow again.

Third, you have full compatibility. All existing system RAM, hardware, and peripheral cards can be used without software modification. Our boards operate with LAN and mainframe communication products and conform to the Lotus/Intel/Microsoft Expanded Memory Specification (EMS). Software compatibility is virtually universal.

Fourth, these are the best. There are several other boards on the market. We at PCSG have compared them all, but there simply is no comparison. What we discovered is that many cards being sold offer only a marginal speedup in spite of their claims and others are just poorly engineered. For example some boards have a cumbersome mechanical switch for going back to 8088 speed, but the Breakthru boards have speed switching software that allows you to drop back to a lower speed on the fly for timing sensitive applications. The 8MHz BREAKTHRU 286 and the 12MHz are unequivocally the best executed and most completely reliable speedup boards manufactured today.

CIRCLE 469 ON READER SERVICE CARD

We are so pleased with the BREAKTHRU speedup card. We use them on our own PC's to make them faster than AT's. We are really excited about this product.

PCSG makes the unabashed statement that the BREAKTHRU 286 card represents more advanced technology than boards by Orchid, Quadram, P.C. Technologies, Phoenix...we could go on. The Breakthru 286 is undisputedly the fastest turbo board with the biggest bang for the buck. And we include FREE the \$89.95 acclaimed Lightning software, which complements the Breakthru 286 by dramatically speeding up disk operations.

But an ad can't let you experience it for yourself. That's why we sell either BREAKTHRU 286 8MHz or 12MHz on a 60-day trial. If you aren't completely satisfied return it within 60 days for a full refund. Call today with your MasterCard, Visa, American Express or COD instructions and we will ship your card the very next day.



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UTILITIES TURBO PASCAL

Borland International's Turbo Pascal took the programming world by storm with its introduction in late 1983. A great compiler combined with a good editor at an astounding price, the package quickly came to be called, simply, Turbo—and has sold more than 500,000 copies. There's even a Turbo Power User column in *PC Magazine*.

With so many people speaking Turbo, it's not surprising that an entire support industry has grown up around the Borland package. Debuggers to test Turbo-generated programs and toolboxes that expand upon the compiler's intrinsic features can upgrade Turbo's already impressive credentials. No serious user should pass them up.

When it hit the stands 4 years ago, Turbo Pascal was a programmer's dream come true. Here are some debuggers and toolboxes that make a good thing even better.

■ TURBO PASCAL UTILITIES

POWERFUL TIME-SAVERS Although Turbo Pascal has a method for executing programs as they are developed, it offers no good way of testing them. One could argue that testing methods that might otherwise be tedious—for example, adding and removing Write statements line by line to track a program's path—become less bothersome given Turbo's speed. That argument turns feeble, however, once you've used a real debugger. Nothing can replace its power.

Normal "assembler" debuggers like DOS DEBUG or SYMDEB are ill suited to Turbo. Turbo Pascal generates an executable .COM file directly or compiles directly into memory, performing no link step and generating no link map in either case. That makes it hard to figure out something as basic as where the user code starts. As one who has tried to test Turbo programs with DEBUG, I can confirm that the task is essentially hopeless. And even if it weren't, having to exit Turbo to test a program under a separate debugger would defeat the ease and speed of Turbo Pascal.

Turbo debuggers are much like assembly language debuggers except they work with Turbo Pascal, not against it. Besides that, their "base language" is Turbo itself, so the programmer needn't be an accomplished assembly language programmer to debug his Pascal program adequately.

Anyone who develops Turbo Pascal programs without using a source code debugger either hasn't tried one yet or simply doesn't value his time. If you employ programmers to develop code in Turbo Pascal, you should furnish them with one of the two packages reviewed here since they both are particularly flexible debuggers. The time savings on the first day will repay the investment.

T-DebugPLUS is a completely compatible, command-driven debugger that operates as a shell over the Turbo compiler. The *GSI Pascal Debugger* is a separate, menu-driven Pascal compiler/debugger that is generally compatible with Turbo. Either one can speed up your Turbo programming.

TOOLBOXES EXPAND TURBO'S CAPABILITIES Toolboxes either expand on features already present in Turbo Pascal or add totally new capabilities. Only a lan-

guage with a following as large and diverse as that of Turbo Pascal could have spawned so wide a range of toolboxes: you can find programs to support everything from menus to matrixes. They generally take the form of "include" files that the user integrates into his own source program using Turbo's INCLUDE statement.

Documentation included with these toolboxes explains the calling sequence to each function, what each does, and what each returns. Source programs are usually fully "commented," with capsule explanations written into the program itself so that you can customize routines for the exact application. Often, example programs illustrate the routines, a further help in getting started.

We checked out Turbo Pascal toolboxes from four manufacturers—Blaise Computing, Borland International, Kris Jamsa Software, and M&T Publishing. Though it is true that other manufacturers also supply toolboxes for Turbo, these four grant a right that some others don't: you're free to sell or give away the programs that you generate with their packages. For any serious programmer, that's an important liberty indeed.

DEBUGGERS

GSI Transcomm GSI PASCAL DEBUGGER

GSI Transcomm bills this product as a debugger for Turbo Pascal, but that's only partly true. The package is actually a separate Pascal compiler that supports an integrated debugger and is Turbo compatible. The *GSI Pascal Debugger* cannot generate a .COM file. It doesn't even generate 8086 machine code as output, choosing instead an intermediate pseudo-code (usually called simply "p-code") that the debugger executes. Essentially, you create and perfect your Pascal program using the *GSI Pascal Debugger*, then compile the completed code with Turbo Pascal into final executable form.

Clearly, developing and debugging a program under the *GSI Pascal Debugger* and then recompiling under Turbo would probably be faster than blundering ahead, line by line, using Turbo alone. Still, I do

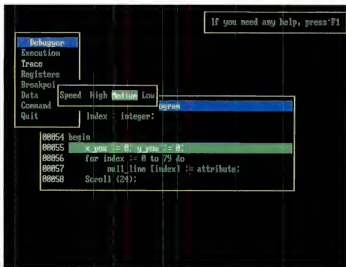
■ Anyone who develops Turbo Pascal programs without using a source code debugger either hasn't tried one yet or simply doesn't value his time.

have one problem with this approach. Though GSI Transcomm has tried its best to make its compiler identical with that of Turbo, it's just not possible to make two things as complicated as compilers act exactly the same.

For example, the release I tested, Version 1.00, does not support INLINE or overlays, two important programming features. (A later release has overcome the first problem but appears not to have tackled the second.) Further, I tried compiling some already completed, functional Turbo Pascal programs I had on disk. Most came up with some sort of compilation error under the *GSI Pascal Debugger*—although, in fairness, the errors were all trivial and easy to correct. Only one rather complex program, which had many direct memory accesses to different addresses, would not execute properly under the *GSI Pascal Debugger*.

SLOW FLOPPIES, FAST MENUS

Though the *GSI Pascal Debugger* consists of separate files for the debugger and compiler, you can pretty much ignore this distinction since the compiler is automatically executed from the debugger. On floppies, GSI's compile speed is noticeably slower than Turbo's because of this program chaining, and because GSI's compiler generates scores of temporary files used later by the debugger. Copy the whole thing over to RAM or to a hard disk, and compile speed is very good. The *GSI Pascal Debugger* supports configuration files that allow the temporary files to go automati-



GSI Pascal Debugger uses point-and-shoot menus. The window in the center of the screen shows that medium-speed trace is the mode currently selected. Notice that the executing line is displayed in the program window in inverse video. The help prompt in the upper-right-hand corner appears whenever the user does not enter a command promptly.

cally to a RAMdisk without the need to copy things back and forth.

The program is completely window-oriented, with all commands in point-and-shoot menus. Though interfaces like these sometimes slow things down, that's not the case here: GSI's well-planned windows allow for rapid operation. Even with the menu-driven system, you can get context-sensitive help by tapping F1 from any location. The configuration window lets you customize almost every aspect of GSI; the program obligingly saves these specifications to disk for the next start-up. In fact, one of the specs it saves is the file being debugged, so even if you exit and reenter GSI, you don't need to reselect a file until you're ready to debug something else.

To use the GSI Pascal Debugger, you first select the file to be debugged, aided by directory commands. You then point at COMPILER and hit return. Like Turbo itself, if GSI detects an error, it places you in the editor at the source of the problem. GSI's editor, though less powerful than Turbo's, is good enough for most programming chores.

Once compilation is complete, you

point at DEBUG and enter the debugging window. From there, all of the usual commands are available. The program shares many features with T-DebugPLUS: you can single-step, go to a line, set a permanent breakpoint, and so forth. With GSI, however, instead of entering the command and line numbers, you point at the debug command, hit Enter, point at the line number, and hit Enter again. The entire process takes about half an hour to get used to; from then on, it's pure silk.

STEP BY STEP GSI has two singular features. First, in addition to manual trace, GSI has an auto-trace mode under which it single-steps on its own. You can select fast, medium, or slow. Slow is more useful than fast, since the former pauses one second between steps, giving you a chance to think, while the latter runs as fast as it can. The other unusual feature of GSI is that, since the debugger is actually executing p-code, you can always stop execution with Ctrl-Break. The user code can never run away from you.

GSI does not have a Show User Screen command, but luckily the windows do not

take up the entire screen, so the user code is always clearly visible in the background. Simply by moving the windows around, you can reveal any section of the user screen. A Hide Windows command and a Change Window Size option would have given users a bit more control, however.

The manual is a skimpy 95 pages, much of which is devoted to the debugger rather than the compiler. This is no real problem, since you'll have the Turbo manual to explain the language. The GSI package fits easily on one floppy disk with plenty of room for TURBO.COM left over. The GSI Pascal Debugger requires 256K of RAM and DOS 2.0 or later. Also, CONFIG.SYS must specify a minimum number of files and buffers.

The GSI Pascal Debugger is an incredible product, especially for an initial release. (GSI Transcomm has already issued a subsequent version that remedies some problems of the original.) Also, with its compilation to p-code, GSI has opened the door to an entire family of debuggers, each with a different compiler but with exactly the same debugger. That means only one user interface and one set of commands to learn, independent of the programming language. Whatever the future holds, however, the GSI Pascal Debugger today is a standout debugging tool.



FACT FILE

GSI Pascal Debugger
GSI Transcomm
1380 Old Freeport Rd.
Pittsburgh, PA 15238
(412) 963-7270
(412) 963-7271
List Price: \$49.95 + \$5 shipping.



Requires: 256K RAM, one floppy disk drive, DOS 2.0 or later.

In Short: Actually a Turbo-compatible compiler with an integrated debugger, the GSI Pascal Debugger operates with a surprisingly fast menu-driven interface. For most applications, it's an excellent debugging tool, although its compiler could pose slight compatibility problems with Turbo's. Not copy protected.

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■ TURBO PASCAL UTILITIES

```

end
end;

(*****write a string to the display screen*****
23 Procedure QWrite (outstring : string);
var
  count : byte absolute outstring;
  temp : integer;
  offset : integer;
  fscreen : array [0..1999] of integer absolute screen;
begin
24   offset := rows [y_pos];
25   for temp := 1 to count do
     begin
26     value := attribute + Integer(outstring [temp]);
     (*
       repeat until ((Port[$3da] and 8) = 8);*)
Source: Memory | T-DebugPLUS 1.04
+-----+-----+-----+-----+-----+-----+-----+-----+
d rows[0..24]
0  00  160  240  320  400  480  560  640  720
800  880  960  1040  1120  1200  1280  1360  1440  1520
1600 1680 1760 1840 1920
d outstring
this is so called hisped output'
+-----+
t

```

T-DebugPLUS highlights the current line in yellow (see the upper window). The code shown here is sitting at breakpoint. If you look at the display in the lower portion of the screen, you'll see that T-DebugPLUS knows that "rows" is an array and that "outstring" is an ASCII string.

TurboPower Software T-DEBUGPLUS

T-DebugPLUS, from TurboPower Software, started life as a public-domain product called *T-Debug*. TurboPower later purchased the rights to *T-Debug* and began marketing it with the "PLUS" added. Though I was initially skeptical of that suffix, TurboPower has indeed made—and continues to make—impressive improvements and additions to the original package. *T-DebugPLUS* now has more commands and greater flexibility than its predecessor; it can also handle larger files and more variables. It has left its older sibling far behind.

T-DebugPLUS runs as a shell over Turbo. Instead of entering TURBO to start, you enter TDEBUG. The debugger then goes out and loads Turbo automatically. Because of this, *T-DebugPLUS* is specific to particular versions, currently supporting only Version 3.00b and 3.01a of normal, BCD, and 8087 Turbo Pascal. It also consumes 175K more of RAM than does Turbo alone.

As you browse through one of your Pascal source programs using *T-Debug-*

PLUS Turbo editor, you may be completely unaware of the shell program's presence—until you try to execute your program. When you enter Run after compiling to RAM, *T-DebugPLUS* takes over, bringing up a split window with a horizontal bar slightly below the middle of the screen. The upper window displays your Pascal source, with line numbers attached to each executable line and with one of the lines highlighted. The lower window carries a command prompt that waits for a *T-DebugPLUS* instruction.

TOTALLY INTEGRATED Though this unexpected behavior is a little unsettling at first, from then on the debugger works quite logically—and it's totally integrated into the Turbo environment. The cursor keypad lets you navigate through your source program as expected. In addition, *T-DebugPLUS* commands can move you directly to a specific line number without panning or will let you view Pascal source contained in include files. Pressing F10 brings you back to the original user screen. *T-DebugPLUS* also supports two-monitor operation.

No matter how many cursor keys you

press, the command prompt will still sit in the lower window; *T-DebugPLUS* waits for you to make the first move. Press "q" and you'll get non-context-sensitive help in the command area, with every command briefly listed. Those commands provide close control over the debugging process. T (Trace) lets you single-step one line of your source code; the screen blinks and the highlight bar moves down one line. As you approach a function call, *T-DebugPLUS* will automatically repaint the screen, moving the highlight to the first line of the function. When you enter N (Next), the debugger executes function calls as a single statement, leaving you at the current level. These flexible schemes will make tired programmers think they've died and gone to heaven.

The commands to control variable contents are similarly useful. Enter D (Display) followed by a variable name, and the program spits out the variable's current value. *T-DebugPLUS* knows the type of the variable and adjusts the output accordingly: strings appear as strings, integers as integers, and so on. If the variable's value is incorrect, the E (Edit) command displays it in every base known to man—decimal, octal, hex, ASCII, and binary—and waits for you to enter a new value in any of those bases. If you need to skip over to a particular line number, the G (Go) command causes Turbo to execute up to the specified line before halting. When you've



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FACT FILE



T-DebugPLUS
TurboPower Software
3109 Scotts Valley Dr
Scotts Valley, CA 95066
(800) 538-8157
(408) 438-8608
List Price: \$60
Requires: 256K RAM,
two disk drives, DOS 2.0 or later, Turbo Pascal
Version 3.00b, 3.01a of normal, BCD, or
8087.

In Short: A superb Turbo debugger, *T-DebugPLUS* operates as a shell over the Turbo compiler. It features an intuitive, command-driven interface, a flexible array of functions, and some useful utilities. Not copy protected.

SINGLE COPY OF TURBO POWER SOFTWARE

FORTRAN PROGRAMMERS

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■ TURBO PASCAL UTILITIES

confirmed the error, entering Q (Quit) drops you back to the Turbo menu, from which you can easily fix the problem and retest the program.

THE BREAKING POINT This brief sample of *T-DebugPLUS*'s powerful functions in no way exhausts the commands available. Instructions exist to display the results of I/O functions or the currently allocated heap blocks, available memory, and the like. In addition, *T-DebugPLUS* gives permanent breakpoints. Conditional breakpoints are not available but can easily be created artificially by entering the conditional as Turbo Pascal statements (the procedure is explained in the manual). The current version of *T-DebugPLUS* also lets you set breakpoints in overlays.

The *T-DebugPLUS* manual is informative but essentially unnecessary after the program is up and running. The prompts provided by the help menu are enough for most things; the commands themselves are fairly self-explanatory. One place the manual might come in handy is if you plan to run *T-DebugPLUS* with your own debugger. Under this arrangement, *T-DebugPLUS* allows the user to drop into the assembler debugger for detailed work and then pop up to resume with the Turbo debugger. As a further aid, *T-DebugPLUS* includes an X command to display the addresses of lines of code and variables for use later within the assembler debugger. Although this command sounds useful, *T-DebugPLUS* is so powerful that it should be necessary only rarely.

T-DebugPLUS includes several other utilities, two of which are of special note. TMAP generates a .MAP file with the addresses of all the variables and statement numbers within a user program—a useful plus for assembler debugging. Since TMAP's output format is the same as that of the DOS linker, you can use symbolic debuggers like SYMDEB and Periscope, an ability until now sorely lacking in Turbo Pascal.

Another utility, MAKELIST, takes the .MAP and .COM files generated from TMAP and produces a disassembled list file, with the Pascal source included as comments. The effect is identical to those compilers with an "object" option that includes assembler output in the listing files

they generate. This should help assembler types who want to examine certain instructions carefully or those wondering about the quality of Turbo's code. It's less useful if you want to learn assembler, as compilers often generate assembler difficult for humans to understand. (Fortunately, machines can read it just fine.)

It is difficult to praise *T-DebugPLUS* too highly. The original package was impressive, but TurboPower Software has not rested on any laurels; the recent additions are numerous and significant. This is the most important Pascal tool I've seen since Turbo itself.

TOOLBOXES

Blaise Computing Inc. TURBO POWER TOOLS PLUS

The *Turbo Power Tools Plus* toolbox from Blaise Computing acts as general-purpose addition to Turbo Pascal. Couched on three floppies stuffed into a 300-page, IBM-style three-ring binder are routines to handle string manipulation, screen control, window management, menus, DOS functions, file handling, directory maintenance, memory management, and interrupt service calls. *Turbo Power Tools Plus* requires DOS 2.0 or later (Blaise recommends 3.0 or later) and Turbo 2.0 or later.

The routines are well documented and

■ Turbo Power Tools *Plus* has a unique interrupt service routine that lets you build pop-up programs in Turbo.

well written—particularly the string manipulation routines, which are notably more powerful than most. The unique interrupt service routine section lets you easily build your own memory-resident, pop-up programs in Turbo Pascal. *Turbo Power Tools Plus* includes no example programs, however, for most of the entry points. Also unique to *Turbo Power Tools Plus* is an INCLUDE utility that can aid in building include statements to incorporate all of the modules necessary to a particular routine. Since different toolbox routines are often interconnected, this is an attractive feature. As a general-purpose toolbox, *Turbo Power Tools Plus* scores well.

Borland International Inc. NUMERICAL METHODS TOOLBOX

TURBO DATABASE TOOLBOX TURBO GRAPHIX TOOLBOX TURBO TUTOR

The inventor of Turbo Pascal itself, Borland is also a big player in the toolbox market. We looked at four of the company's six toolbox packages: *Numerical Methods Toolbox*, *Turbo Database Toolbox*, *Turbo Graphix Toolbox*, and *Turbo Tutor*. (*Turbo GameWorks* and *Editor Toolbox* were omitted. Though they're among Borland's biggest sellers, they lack interest for professional programmers: one generates game software, the other is a *WordStar*-type text editor. Both are unlikely applications in serious programming work.)

All of Borland's toolboxes come with a bound manual, the famous Borland "no nonsense" copyright agreement, and invitations to join the Turbo User Group and

**FACT FILE**



Turbo Power Tools Plus
Blaise Computing Inc.
2560 Ninth St., #316
Berkeley, CA 94710
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(415) 540-5441
List Price: \$99.95
Requires: 128K RAM,
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■ TURBO PASCAL UTILITIES

the CompuServe Turbo Special Interest Group, both good sources of Turbo help. (Borland employees monitor the Turbo SIG to answer questions that arise.) Borland is the only company reviewed here that offers versions of its software for 3½-inch floppies, available by returning the master disk with an extra \$15 shipping charge.

The Borland Turbo toolboxes require DOS 2.0 or later. They also prefer Turbo Pascal Version 3.0 or later, although most will execute under Version 2.0 with little or no trouble.

NUMERICAL METHODS TOOLBOX

Unlike the other toolboxes, the *Numerical Methods Toolbox* presents no overwhelmingly important applications. Instead, it offers mathematical routines such as solutions of equations, interpolations, calculus, numerical differentiation and integration, matrix manipulations, differential equations, least-square approximations, and fast Fourier transforms (FFTs). The *NMT's* routines and example programs had to be squeezed to fit onto its three floppies, but an unsqueeze utility is also included. The technical reference section of the manual is exhaustive.

In addition to the normal Borland requirements, the company recommends using an 8087 coprocessor with the *NMT*—a reasonable suggestion given the nature of the toolbox. Some example programs also require the *Turbo Graphix Toolbox*; the two packages mesh together nicely.

The *NMT* covers lots of territory. There is little room in the manual for theoretical discourses. On the other hand, each routine is thoroughly explained, and each has a companion example program. Routines are divided up into groups: for instance, there might be four different curve-fitting programs, each preferred for certain types of data. A mathematician who understands the nuances will find in the *NMT* an absolute gold mine. If you write mathematical software, don't pass this one up.

TURBO DATABASE TOOLBOX

The first toolbox available for Turbo Pascal, this package has begun to show its age. Three different sections of the manual and software cover B-trees, sorting algorithms, and installing the completed pro-

gram—but they're built around a specific database application, and that detracts from the program's general usefulness. The manual is much wordier than most, devoting large sections to the example application and to the philosophy of B-trees and sorting. A single 40-page technical reference section of the manual, however, does call out the specific entry points and describes the arguments to each. As an initiation into the world of writing database applications, the *Turbo Database Toolbox* is okay; the example program is well written and well commented. Because the program's application-specific design tends to make its routines interconnected, however, pulling out individual routines for a

user-written database may be a chore. The *Turbo Database Toolbox*, though useful as it sits, could stand a little updating.

TURBO GRAPHIX TOOLBOX

Routines on the *Turbo Graphix Toolbox's* single floppy disk support the CGA, Hercules, EGA, AT&T 6300, IBM 3270, and Zenith Z100 standards. The manual's introduction includes a description of each standard, as well as a discussion of PC graphics in general. The technical reference section of this toolbox's manual is much larger than that for the *Database* toolbox; the routines, too, are much more general. Topics include producing different-sized text, windowing, generating pie



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EDITOR'S CHOICE



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Scotts Valley, CA 95066
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List Price: \$54.95

Requires: 128 K RAM, two disk drives or hard disk, DOS 2.0 or later, Turbo Pascal 2.0 or later.

In Short: Borland's first Turbo toolbox might come in handy for certain database applications, although the routines are somewhat narrowly focused and inflexible. Not copy protected.

CIRCLE 668 ON READER SERVICE CARD



Turbo Tutor

Borland International Inc.
4585 Scotts Valley Dr.
Scotts Valley, CA 95066
(800) 255-8008
(800) 742-1133 (in Calif.)

List Price: \$34.95

Requires: 128K RAM, two disk drives or hard disk, DOS 2.0 or later, Turbo Pascal 3.0 or later.

In Short: Not strictly a toolbox, *Turbo Tutor* presents examples of virtually every legal Turbo Pascal construct. Not copy protected.

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■ TURBO PASCAL UTILITIES

and bar charts, plotting, and curve fitting.

To give you some freedom from using particular display adapters, the *Turbo Graphix Toolbox* introduces a concept it calls the "world," a hardware-independent system of screen coordinates used in drawing and filling. Unfortunately, if you're changing display adapters you still have to recompile the user code. It would have been nice if the toolbox could sense the adapter type at run time to eliminate this recompiling requirement.


Example programs that the *Turbo Graphix Toolbox* contains easily generate pie charts and bar charts and will fit curves on plots of data. Other examples use window routines to pan both horizontally and vertically and to save, restore, and invert windows, as well as perform window clipping and sizing. Anyone wishing to generate attractive screen output easily and quickly should consider this powerful collection of graphics routines.

TURBO TUTOR *Turbo Tutor* is not strictly a toolbox, since it contains only examples of Turbo constructs rather than new routines. Still, the package includes a lot of good Turbo code—some 10,000 lines' worth. Programs contained within the Tutor can be adapted to almost any problem. By demonstrating nearly every legal Turbo construct, *Turbo Tutor* can be a timesaver for Turbo programmers. Also, a special utility lets you execute sample programs while viewing the source code at the same time. This eases the chore of finding the right example to fit the problem at hand. For its low price, *Turbo Tutor* is a useful add-on to the Turbo Pascal manual.

Kris Jamsa Software Inc. TURBO PASCAL

PROGRAMMER'S LIBRARY

Packed in a largish three-ring binder, the manual for the *Turbo Pascal Programmer's Library*, from Kris Jamsa Software, gives you no theory or description at all—just lists and lists of fully documented entry points, some 200 altogether. The package's two floppy disks contain routines to supplement the standard Turbo Pascal library, including array and string manipu-




FACT FILE

**Turbo Pascal
Programmer's Library**
Kris Jamsa Software Inc.
P.O. Box 26031
Las Vegas, NV 89126
(702) 363-3431
List Price: \$59.95

TURBO PASCAL

Programmer's Library



Requires: 256K RAM,
two disk drives, DOS 2.0 or later, DOS 3.0 or
later for file-handling routines, Turbo Pascal
2.0 or later.

In Short: A collection of well-written but
rather simple routines for string manipula-
tion, math, sorting, I/O functions, and the
like. The documentation supplies little back-
ground. Not copy protected.

CIRCLE 688 ON READER SERVICE CARD

lation, math, sorting, dynamic lists, pipes, menus, and I/O. The package also includes add-ons to Borland's *Turbo Graphix* and *Turbo Database* toolboxes. Kris Jamsa's package has some unique requirements: you must use DOS 3.0, you must include ANSI.SYS in the CONFIG.SYS file, and, of course, you must have the Borland toolboxes in question if you want to use their supplements.

Most of the routines it contains are fairly simple; in fact, you get the feeling that there's some filler. There isn't too much here that the average programmer couldn't have written for himself, but why spend the hours and hours necessary to get it to work when Kris Jamsa has done such a nice job of implementing these routines already? Beginning programmers could also use the Kris Jamsa routines as examples of how to do it right. The programs are well written, nicely commented, and adequately documented. They make a nice addition to any Turbo library.

M & T Publishing Inc.

STATISTICAL TOOLBOX

TURBO ADVANTAGE

TURBO COMPLEX ADVANTAGE

Like Borland, M&T Publishing offers a family of toolboxes, each serving different needs. We looked at three: *Statistical Toolbox*, *Turbo Advantage*: Source Code

Libraries for Turbo Pascal, and *Turbo Complex Advantage*: Complex Number Routines for Turbo Pascal. (The company offers others, but you can't resell their output.)

STATISTICAL TOOLBOX The two floppy disks in this package include every sort of statistical routine: statistical significance testing, linear regression, polynomial regression, random-number generators, and the like. The manual explains the calling sequence sufficiently, if tersely; the code comments are similarly succinct. You also get simple example programs for each routine, a few of which require Borland's *Turbo Graphix Toolbox*. The two toolboxes complement each other well, since manipulating statistics usually involves graphing and plotting.

Interestingly, the example programs are documented in their own manual, which is separate from the toolbox's. That's a nice touch: once you have mastered the toolbox routines, you can concentrate on the toolbox manual without explanations of irrelevant example programs cluttering things up. The *Statistical Toolbox* presents little or no theory, leaving plenty of rope for the uninitiated, but there's no filler here, either. If you know what you're doing, you'll find it packed with useful routines.

TURBO ADVANTAGE *Turbo Advantage* is a Turbo jack-of-all-trades. The 220 procedures packed onto its one disk cover such topics as hashing, menus, sorting, spooling to printer, and data compression. There's also a special emphasis on mathematical routines, including numerical integration and differentiation, matrix manipulations, regressions, and statistics.

All of the entry points are well commented in the source and curly described in the manual. Each function comes with an example program, many of which are simple-minded and uncommented, but all of which suffice to describe the entry point (which is their goal). *Turbo Advantage* rounds out Turbo Pascal nicely; it would make a useful addition to most libraries.

TURBO COMPLEX ADVANTAGE Turbo Pascal has neither an intrinsic type to handle complex numbers nor any sup-

Interlude II

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CIRCLE 217 ON READER SERVICE CARD

■ TURBO PASCAL UTILITIES



FACT FILE

STATISTICAL TOOLBOX



Statistical Toolbox
M&T Publishing Inc.
501 Galveston Dr.
Redwood City, CA
94063
(800) 533-4372
(800) 356-2002 (in Calif.)

List Price: \$69.95

Requires: 64K RAM, one disk drive, DOS 2.0 or later, Turbo Pascal 2.0 or later.

In Short: This toolbox includes a wealth of statistical routines such as regression and significance testing. Documentation, though brief, is adequate. Not copy protected.

CIRCLE 87 ON READER SERVICE CARD

TURBO ADVANTAGE



Turbo Advantage:
Source Code Libraries for Turbo Pascal
M&T Publishing Inc.
501 Galveston Dr.
Redwood City, CA
94063
(800) 533-4372

(800) 356-2002 (in Calif.)

List Price: \$49.95

Requires: 64K RAM, one disk drive, DOS 2.0 or later, Turbo Pascal 2.0 or later.

In Short: A supplement to the basic Turbo library, with a special emphasis on mathematical routines. Not copy protected.

CIRCLE 88 ON READER SERVICE CARD

TURBO COMPLEX ADVANTAGE



Turbo Complex Advantage:
Complex Number Routines for Turbo Pascal
M&T Publishing Inc.
501 Galveston Dr.
Redwood City, CA
94063

(800) 533-4372

(800) 356-2002 (in Calif.)

List Price: \$89.95

Requires: 64K RAM, one disk drive, DOS 2.0 or later, Turbo Pascal 2.0 or later.

In Short: A must for anyone whose programs require complex numbers, this program defines a complex type for Turbo Pascal and includes routines for manipulating complex numbers. Not copy protected.

CIRCLE 89 ON READER SERVICE CARD

port for user-defined complex types. **Turbo Complex Advantage**, a useful supplement to **Turbo Advantage**, defines a complex type that the user can include in his own programs and contains a variety of routines to perform all of the normal complex-number manipulations. The single



EDITOR'S CHOICE

- T-DebugPLUS
- Numerical Methods Toolbox
- Turbo Graphix Toolbox

Although the GSI Pascal Debugger is a product that can ease the life of many a programmer, T-DebugPLUS just edges out its rival. T-DebugPLUS is a powerful debugger that's completely integrated into the Turbo environment; it gives you a lot of control over your program. You can single-step through, perform function calls as a single statement, and see your variables in practically any form you might want. When you've isolated your error, the program drops you right back into the Turbo editor with no fuss at all. It's an impressive package indeed.

Each of the toolbox programs we reviewed could suit you just fine, depending on your specific needs. Two from Borland stand out, however, for offering exceptional value: the Turbo Graphix Toolbox and the Numerical Methods Toolbox. The first package contains a feast of well-documented routines for generating screen output: bar charts, pie charts, curve fitting, and window manipulation. The second offers a collection of mathematical routines covering practically any application. For the money, these two programs are real winners.

disk covers complex arithmetic, complex matrix manipulation, one- and two-dimensional FFTs, digital filters, and heap manipulation. The program's style is identical to that of **Turbo Advantage**, which it requires in order to run. If you need to work with complex numbers, you'd do well to pick up this package along with **Turbo Advantage**. □

Stephen Randy Davis is a frequent contributor to PC Magazine.

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```
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Command ----

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      EDCD Download Data Set ..

COPY
Command ----

NOTE: Remote subset downloading.
   D > sdcdd download @satellite@pcidat01 usf:
   D gxyz download @satellite@pcidat01 usf:gxyz.mex
   D rms

NOTE: DOWNLOADING IS PROGRESSING FROM DATA=ADDDT, MONTHLY TO CURRANT MON
NOTE: The Data sat PC MON has 300 observations and 89 variables.

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Command ----

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CIRCLE 294 ON READER SERVICE CARD

PC^s and FAX GET IT TOGETHER

*For
20 years,
fax machines have
been whisking documents
containing pictures and text around the
globe in a flash. A growing number of products
allow your PC to perform this function.
Here's a summary of how
fax works and reviews
of seven fax-based
products.*

Fax, short for facsimile transmission, is the superman of document transporters. It can make documents containing both pictures and words leap tall buildings and cross continents in a single bound. And it does so almost instantaneously. While recipients don't get the actual document, they do get a "reasonable facsimile."

Products that turn your PC into a fax machine have been quietly available for years. But recently this area has heated up, with a number of new products announced for introduction in the coming months. That's good news for people who have PCs and want to communicate with fax machines. While a typical fax machine costs between \$2,000 and \$3,000, you can add this capability to a PC for roughly \$1,000. Examining fax technology and looking at some of the currently available products will give you an idea of what to expect when the explosion hits.

FAX FACTS You can think of fax in a number of ways. Fax is like a telecopier—a Xerox machine with a thousand miles of wire between where you slide the original in and where the duplicate falls out. In fact, the now aging telecopiers made by Xerox Corp. were the progenitors of today's fax machines.

Fax is like a television for paper. Much as a television picture is broken into numerous scan lines, a fax machine scans images as a series of lines, one at a time, then strings all the lines scanned on a document into a continuous stream of information. Another fax machine at the receiving end converts the data stream into black and white dots on another sheet of paper that duplicates the pattern of the original.

Fax is like a modem for pictures. While you can send text across wires in digital bytes representing the alphabet, the fax machine serves the same purpose for both pictures and text. Quite understandably,



Fax Modems: Summary of Features

(Products listed in ascending price order)

| | FaxMail Sicom Computer Consultants | FaxMaster Xerox Corp. | GammaFax Gamma Technology | Microtek MFAX96 Microtek Lab Inc. | pc-Fax EIT Inc. | PCFax Sicom Computer Consultants | Path II Pitney Bowes |
|---|---|--------------------------|---------------------------------|--|--------------------|---|-------------------------|
| List price | \$595 | \$695 | \$995 | \$995 | \$1,095 | \$1,595 | \$2,795 |
| Auto-dial/ answering | ● | ● | ● | ● | ● | ● | ● |
| Auto-answer/ receiving | ● | ● | ● | ● | ● | ● | ● |
| Broadcasting | ● | ● | ● | ● | ● | ● | ● |
| High-speed aontax file transmitters | ○ | ○ | ● | ○ | ● | ● | ○ |
| Quasi-background operation | ○ | ○ | ○ | ○ | ● | ○ | ○ |
| Fax-compatible image compression | ● | ● | ● | ● | ● | ● | ● |
| Fax-compatible image storage on disk | ● | ● | ● | ● | ● | ● | ● |
| ASCII-to-iso conversion | ● | ● | ● | ● | ● | ● | ● |
| Built-in OCR capabilities | ○ | ○ | ○ | Optional | Optional | ○ | ● |
| On-screen preview | ● | ● | ● | ○ | ● | ● | ● |
| Image-editing capabilities | None* | None | Limited? | None | Limited? | Full | Limited |

●—Yes ○—No *None without optional Dr. Halo's OPE package.

about half the world's 2 million fax machines are installed in Japan, where pictograms rule.

Fax is becoming increasingly important in Western business, too. Contracts complete with signatures, prescriptions, plans, charts, graphs, drawings, and page layouts all slip through the fax connection with equal facility. Fax is cheaper than any other method of moving business information fast, except for electronic mail. While transferring a one-page document by fax costs the same as a 1-minute telephone call to wherever the document is being sent, Federal Express charges a minimum of \$11 and telex charges \$10 for the first minute. In fact, business has found fax so useful that the installed base of the current generation of machines, termed Group 3, has gone from zero to half a million in less than 6 years.

But the best is yet to come. Fax machines linked to or merged into PCs can

create instant and automatic graphics communications systems. From humble beginnings as task masters ruling over fax machines, PCs are becoming fax stations that create, manage, send, receive, and display

■ Fax machines linked to PCs can create instant and automatic graphics communications systems.

fax images. With the latest PC-based fax systems, you can create a newsletter in *PageMaker* or *Ventura Publisher* and deliver it anywhere overnight without ever touching a sheet of paper.

In addition, the PC is becoming the fax

gateway for larger computer systems and networks. While mainframe fax links are marred by high costs (Tandem's fax card costs about \$12,000) and incompatibilities (IBM's faxlike ScanMaster won't work under the Group 3 standard), PC fax systems are inexpensive and completely compatible. The PC is the logical link between the mainframe database and worldwide distribution of graphics information.

BY THE NUMBERS The concept of facsimile transmissions is hardly new. As early as 1842, Alexander Bain patented an electromechanical device that could translate wire-based signals into marks on paper. Newspaper wire photos, which are based on the same principles, have been used for generations.

The widespread use of fax in business is a more recent phenomenon, however, and its growth parallels that of the PC for much the same underlying reason. Desktop com-

puters did not take off until the industry found a standard to follow—the IBM PC. Similarly, the explosive growth of fax began only after the CCITT (an abbreviation for the French rendering of the International Cooperative Committee for Telephone and Telegraph, an organization that is part of the United Nations) adopted standards for the transmission of facsimile data.

The original system, now termed Group 1, was developed in the mid 1960s. It was based on analog technology and used frequency shift keying, much as 300-bit-per-second modems do, to transmit a page of information in 6 minutes. Group 2, which came into widespread use in 1976, improved that analog technology and doubled the speed of transmission to 3 minutes per page.

The big break with the past was the CCITT's adoption in 1980 of the Group 3 fax standard, which is entirely digital based. Group 3 is backwardly compatible with Groups 1 and 2, and the machines cost from \$2,000 to \$3,000. Using data compression and modems that operate at up to 9,600 bits per second, full-page documents can be transmitted in 30 to 60 seconds using the Group 3 standard. The data compression makes the speed of transmitting a page dependent on the amount of detail that it contains. In operation, the data compression algorithm reduces the amount of data that must be transferred by a factor that ranges from 5 to 10. On the other hand, a bad phone connection can slow fax transmission because fax modems automatically fall back to lower speeds to cope with poor line quality.

Under the Group 3 standard, two degrees of resolution or on-paper sharpness are possible (resolution also affects speed): standard, which allows 1,728 dots horizontally across the page (about 200 dots per inch) and 100 dots per inch vertically; and fine, which doubles the vertical resolution to achieve 200 by 200 dpi and requires about twice the transmission time.

In 1984 the CCITT approved a super-performance facsimile standard, Group 4, which allows resolution as high as 400 by 400 dpi, as well as higher-speed transmissions at lower resolutions. Group 4 is also backwardly compatible with the previous standards, and these machines are priced from \$3,000 to \$13,000. Although they do

not produce typeset quality (phototypesetters are capable of resolutions of about 1,200 dpi), the best of Group 4 is about equal to the resolving ability of the human eye at normal reading distance. However, today's Group 4 fax machines require high-speed, dedicated lines and do not operate as dial-up devices. The ill-fated (now

■ The latest innovations make combining the fax machine and PC into a single entity as easy as adding an expansion board to your computer.

discontinued) Zap Mail services offered by Federal Express were based on Group 4 facsimile equipment.

Of the three dial-up fax standards, Group 3 is far and away the most popular in use today. Of the roughly three-quarter million fax machines in the United States and Canada, about 44,000 are Group 1, 150,000 are Group 2, and over half a million are Group 3.

UNIVERSAL FAX Fax is not for everyone, at least not yet. If you just want to send images to someone else with a PC, the fax connection may not be your best choice. Ordinary graphics files are generally more compact and will save both disk space and transmission time. And the mere transmission of images does not justify the expense of adding true fax compatibility to your system. You can get all the capabilities of a true fax system with existing graphics and communications software—if both the sender and recipient have access to the same graphics software.

With fax, however, there is no question of software compatibility. Fax requires that all graphics information be distilled to the same format, which guarantees compatibility with any fax-compatible system. This graphics standardization is fax's most important advantage.

From a practical viewpoint, the most important applications of PC-based fax today is its ability to send and receive documents to and from the installed base of facsimile equipment.

Transmitting to fax machines offers several advantages: fax reception is essentially automatic. The fax machine answers the line and starts its chore of churning out paper. When the transmission ends, it hangs up and waits for the next call. Unattended operation is not just possible, but a design intent.

In addition, fax machines are designed to be simple to use and accessible. Secretaries and executives who refuse to touch a computer have little trouble with fax. For them, a fax machine is like a telephone you sometimes have to load paper into.

Fax holds a bigger promise, however. Group 3 is an accepted standard for the interchange of graphics information, at least in telecommunications. Its move into the PC arena may mark it as the long-awaited PC graphics standard that could bring order to the chaos of file and storage formats for graphics information.

COMPUTERIZED FAX The first link-ups between fax and the PC were mere handshakes, but today the affair has become more intimate. When the two technologies first met, they kept their individual identities, joining together through a serial port. With the latest innovations, however, combining the fax machine and PC into a single entity is as easy as adding an expansion board to your computer.

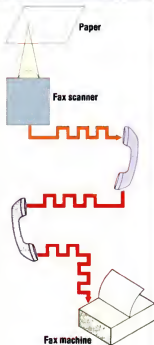
Xerox Corp. made one of the first PC-to-fax connections by tying an ordinary facsimile machine, the 495-1, to a PC. The fax machine performed the normal fax functions, scanning, transmitting, and regenerating documents. The PC controlled the process. It sent commands to the fax machine telling it to dial the phone and deliver transmissions to entire groups of recipients. The PC could also access the fax data stream, recording it on-disk, storing documents, or previewing images before they were sent or after they were received. A software utility could convert standard ASCII files into fax-compatible data.

The new approach does away with the fax machine entirely. Instead, it substitutes a fax-compatible, high-speed modem that



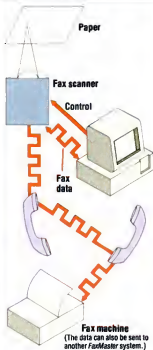
The Three Faces of Fax

Traditional Fax



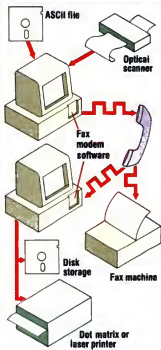
The fax scanner reads the images on a document one line at a time and converts them into pulses representing the black and white areas on the paper. The resulting signal is carried over ordinary telephone lines. The print mechanism on the fax machine at the receiving end converts the digital pulses back into scan lines on another sheet of paper, duplicating the pattern of the original.

FaxMaster

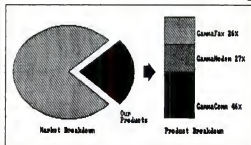
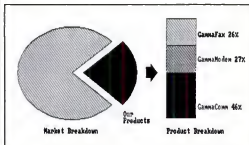


In one of the first PC-to-fax connections, Xerox Corp. tied an ordinary fax machine to a PC. The fax machine performed all the typical fax functions of scanning, transmitting, and regenerating documents. The PC controlled the process by sending commands to the fax machine, telling it to dial the phone and deliver transmissions to recipients. The PC could also access the fax data stream, recording it on-disk, storing documents, or previewing images before they were sent or after they were received. A software utility could convert standard ASCII files into tax-compatible data. This method is still used by Xerox's *FaxMaster*, reviewed here.

True PC Fax

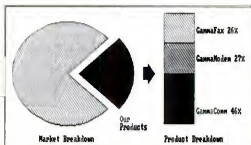


This approach does away with the fax machine, substituting a tax-compatible, high-speed modem that you install inside your PC. The PC itself creates the fax images, but they can also be derived from a peripheral image scanner, typically the Canon IX-12. When a fax transmission is received, it is displayed on the monitor screen or printed using a standard dot matrix or laser printer. Special software can convert ASCII and even some graphics files into fax format. Incoming and outgoing calls are managed much as they are in the linked fax-and-PC systems. Images can be graphically edited either before or after transmission.



JUDGING OUTPUT QUALITY

These charts represent three output options today's users have and three corresponding levels of image quality. Image 1 is the original, created on a PC and printed on a laser printer. Image 2 is sent from a traditional Group 3 fax to another of the same. Image 3 was sent from a PC to a fax machine. As you can see, the PC-to-fax image has a higher resolution than that sent from fax to fax. The reason is that the computer can optimally place each dot to give the sharpest apparent resolution.



you install inside the PC. The PC itself creates the fax images—or they can be derived from a peripheral image scanner, typically the Canon IX-12. When a fax transmission is received, it is displayed on the monitor screen or printed using a standard dot matrix or laser printer. Special software can convert ASCII and even some graphics files into fax format. Incoming and outgoing calls are managed much as they are in the linked fax-and-PC systems. Images can be graphically edited either before or after transmission.

In truth, the capabilities of the two systems have converged. Once fax data is in any PC, it can be similarly manipulated. The only important difference is that in systems that link a PC to a fax machine, the fax machine can also function separately, while the fax machine in a PC is inseparable. On the other hand, two separate machines cost substantially more than does a simple PC enhanced with a fax modem board and they clutter up your office.

The primary advantage of either link up is convenience. Without the connection,

you'd have to print out a document made by your PC, then scan it into the fax machine. When you receive something without the PC-to-fax connection, you would have the paper copy as the starting ground for any manipulations you'd want to

■ PC-based fax has apparently reached its critical mass and is about to explode onto the marketplace.

make. Unless you have a scanner, that means pulling out the scissors and rubber cement if you want to make changes.

Link the PC and fax, and you can work on the screen, editing with painting programs or electronic publishing editors.

Once you've captured an image with a scanner, you can use optical character reader (OCR) software to convert fax documents into ASCII text to edit.

Going the other direction, you can create fax documents using your word processor or, with the appropriate conversion software, any other program. Instead of printing out the results, you send them out by fax.

Creating fax on the PC confers an added advantage: an apparent increase in resolution. By their nature, scanners must make do with whatever they're fed. Unless the edge of a character or line perfectly matches the edge of a scanning cell, it is ambiguous whether the corresponding dot should be black or white. As a result, scanned characters can have fuzzy or jagged edges. When a computer makes a character and prints it out using a fax machine, it can optimally place each dot to give the sharpest apparent resolution. Fax text and graphics created on a PC thus look better than anything scanned in.

Over the last 4 years, the PC-based fax

Still thi



40 MB. In a 1" card. We told our engineers it couldn't be done. That everybody else uses a 2" card. Or an add-in drive the size of a breadbox.

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CIRCLE 499 ON READER SERVICE CARD

■ PCs AND FAX

market has been a quiet arena boasting few products, little sales volume and scant media attention. Until recently, the one pre-eminent product for putting fax inside PCs has been Gamma Technology's Gamma-Fax system. Essentially a fax-compatible internal modem and software, GammaFax has, for the last 2 years, proved to be such a cost-effective product that other manufacturers have built systems around it.

The potentials and promises of these first linkups of PCs and fax—besides the swelling installed base of Group 3 fax equipment—finally have caught the eye of system designers and peripheral makers. As a result, the last few months have been marked by a flurry of announcements and introductions seemingly by everyone with a garage workshop and a telephone line. In November 1986, for instance, Electronic Information Technology (EIT) introduced a modem-and-software system, called pc-FAX, and in the last few months, many more manufacturers have announced similar products of their own.

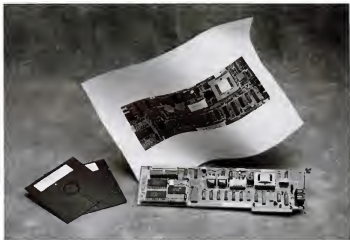
PC-based fax has apparently reached its critical mass and is about to explode onto the marketplace. It holds the potential of becoming this year's hot new PC product area. Fax combines two of the PC's most promising abilities—graphics and communications—and brings a wealth of new possibilities. Finally PCs have a standard upon which they can build image databases and full image-oriented communications systems.

To give you an idea of what's available, as well as a hint at what's coming in the future, *PC Magazine* reviewed the features and capabilities of seven PC fax systems on the market today. All of these products offer the benefit of uniting the power of your PC with Group 3 fax.

..... ELECTRONIC INFORMATION TECHNOLOGY INC.

pc-Fax

Electronic Information Technology is perhaps best known for its scanning and OCR software, which turns typed text into ordinary ASCII files. Fax was an obvious next step, giving EIT's established image processing technology a long-distance reach. EIT entered the fax market last November



The pc-Fax system is based on EIT's own fax modem, a full-length XT-height, 8-bit expansion card that hooks any full-size PC to the international telephone network. EIT supplies two sets of utilities to bring the hardware to life.

with its initial release of pc-Fax. Last February, the company updated the product to Version 2.0, giving it a new software front-end. In this way, they essentially made a one-generation leap in 4 months.

The pc-Fax system is based on EIT's own fax modem, a full-length XT-height, 8-bit bus expansion card that hooks up any full-size PC to the international telephone network. As with 80 to 90 percent of the fax modems available today, the EIT product is based on the Rockwell 9,600-bps modem chip set. It connects to your phone line using a pair of RJ-11 modular jacks: one that goes to the incoming line, and another that optionally connects to your telephone. The EIT modem is hardware definable to act as either COM1 or COM2 in your system.

To bring that hardware to life, EIT supplies a set of utilities linked by two windows-oriented interface programs, Psmenu and Faxmenu. The iconless pull-down menu-selection scheme used makes trial-and-error learning easy. The system gives you your choice of mouse or cursor keys for control.

The Faxmenu program controls all normal fax sending and receiving operations; Psmenu handles manipulations of images before and after they are transferred.

The system includes all the features necessary for normal fax communications, including automatic sending and receiving of fax transmissions, broadcast (calling and sending to multiple remote fax machines) and polling (calling and receiving from multiple fax machines). The pc-Fax system will operate in any of its modes completely unattended in order to take advantage of low-rate calling times. The system permits fax documents to be up to 99 pages long, and the number of remote fax stations to call or receive from is essential-



FACT FILE

pc-Fax

Electronic Information Technology Inc.
373 Rte. 46W
Fairfield, NJ 07006
(800) EIT-SCAN
(201) 227-1447

List Price: \$1,095; OCR option, \$595.

Requires: 512K RAM, graphics adapter, DOS 3.0 or later.

In Short: A hardware and software system that turns any PC into a fax machine and features an easy-to-use interface with pull-down menus.

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scanner can be the source for fax documents.

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CIRCLE 146 ON READER SERVICE CARD



■ PCs AND FAX

ly unlimited. It also maintains a "telephone book"—a disk-based directory from which you can select one number or an entire list to call and which keeps a log of all transactions.

In addition, pc-Fax adds a feature that EIT calls "background" reception of fax files, which lets you use your PC for other

■ Up to 90 percent of fax modems are based on the Rockwell 9,600-bps modem chip set.

purposes when it is not receiving fax messages. Unlike the name implies, reception is not truly handled in the background. When a fax file is received, any application—even pc-Fax editing functions—freezes. This quasi-background compromise helps ensure that nothing interferes with the proper capture of fax files.

The Psmenu functions of pc-Fax allows you to convert ASCII text into fax files and merge fax and ASCII. In addition, EIT's OCR can optionally be added to the pc-Fax system and accessed through Psmenu, giving you the interesting ability to convert some fax messages into ASCII format. The OCR conversion is not universal, however. The EIT software recognizes only four different type fonts but, optionally, has the ability to learn more.

Once a properly formatted image is captured from a fax machine over a phone line or generated from a file, pc-Fax allows several limited editing manipulations, including cropping, scaling, and inverting. You can see the resulting output on most graphics displays, send it to another fax machine (store-and-forward operation), or print it locally using either a 9-pin or 24-pin Epson-compatible dot matrix printer, a Hewlett-Packard Laserjet Plus, or a QMS SmartWriter laser printer. The system supports the following graphic video standards: IBM CGA or EGA (color or monochrome), Hercules graphics, Tecmar Graphics Master, and Micro Display Systems Genius VHR full-page display.

***** GAMMA TECHNOLOGY

GammaFax

Gamma Technology's GammaFax is the standard by which all other PC-based fax systems are judged. Not only was GammaFax the first, but for nearly 2 years it was the only product that enabled virtually any PC to send and receive fax transmissions. Until the end of 1986, nearly all similar products were based on the GammaLink hardware and software system.

The hardware heart of GammaFax is a GammaLink fax modem, a 10-inch-long expansion card that's XT height and uses an 8-bit data bus. The board does not steal a COM port but resides at a number of jumper-defined addresses starting at 150, 250, or 350 hex.

Based on the Rockwell 9,600 bit-per-second modem chip set, the GammaLink board is fully compatible with the Group 3 digital fax standard and automatically falls back to lower speeds when bad telephone connections will not support its top speed. Among other functions, it will automatically dial and answer the line.

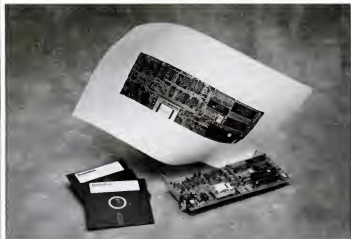
Besides handling fax transmissions, it can transfer binary files between ATs at 9,600 bps or, when a PC is involved in the transfer, 4,800 bps. The overhead required

by its advanced error-checking protocol requires too much processor time for a PC to make binary transmissions at 9,600 bps.

The GammaLink board is easily connected to your telephone system with an 8-pin modular jack. To set it up, you simply plug it in.

The GammaFax software allows the system to operate like an advanced fax machine. It automatically sends and receives (and stores) fax transmissions whenever it is running. You can preset the time you want to send a message (say, after 11 P.M. when phone rates are low) and instruct GammaFax to do the work for you, or you can manually send priority work with a few keystrokes. You can also specify hundreds or thousands of recipients for your documents, and GammaFax can dial each for you. Or you can automatically poll a number of remote fax machines while the rest of the world sleeps. Each document can be up to 999 pages long, and you can send up to 25 documents of that length per session.

The GammaFax system is capable of complete store-and-forward operation. It will also convert ASCII files into fax files for transmissions in one of three built-in fonts, or you can define your own font. The documentation includes instructions



The GammaLink fax modem is a 10-inch-long, XT-height card that uses an 8-bit data bus. The GammaFax software lets the system operate as an advanced fax machine, automatically sending and receiving fax transmissions whenever it runs.



FACT FILE

GammaFax
Gamma Technology
2452 Embarcadero Way
Palo Alto, CA 94303
(415) 856-7421
List Price: \$995

Requires: 256K RAM, DOS 2.0 or later.

In Short: A complete system, including a 9,600-bps modem, that converts any PC into a fax machine with file conversion and automatic sending and receiving capabilities.

CIRCLE 679 ON READER SERVICE CARD

for creating ASCII files with most popular word processors.

GammaFax can also convert screen files into fax format and compress raster-style (*Halo DPE*-compatible) full-page images into fax format. It has limited cut-and-paste abilities but no true built-in graphics editor. However, GammaFax files are compatible with *Halo DPE* (Document Processing Editor).

The GammaFax system has a menu-driven program called GF that you can use to control the system. You step through the menus by pressing function keys—with F1 for forward movement and F10 taking you back to the previous menu. Although earlier versions of the program were notoriously slow, menus of the current release snap onto the screen quickly.

The GF program will also operate in a command-driven mode almost like an interpreted programming language, letting you type in commands directly at its GFAX> prompt. Since it supports command files, you can automate common fax operations. It also keeps a log of everything you do.

Separate programs control file conversions, scanning, and printing operations. All are available at the GammaFax main menu, or you can use them as command-driven programs. The scanning program supports the Canon IX-12 scanner.

GammaFax displays are compatible with most monitors using the EGA, CGA, or Hercules graphics standards. The system also uses the Genius VHR full-page display. You can obtain hard-copy output using 9-pin dot matrix printers (Epson or IBM compatible) or the 24-pin NEC ma-

chine. Canon and Hewlett-Packard LaserJet Plus laser printers are also supported, but only the former allows full pages in high-resolution mode.

..... MICROTEK LAB INC.

Microtek MFAX96

Microtek Lab is another scanner company that has extended the reach of its product with a new fax connection. The Microtek MFAX96 consists of a fax modem and control software that together link up to the Microtek scanner system. However, you can also use the Microtek fax products separately for transmitting, receiving, and printing images.

The Microtek modem is a full-length expansion card, standard XT height, that uses the 8-bit XT data bus. Its essential circuitry is based on the Rockwell high-speed modem chip set and connects to your telephone line using an RJ-11 modular jack. Another jack connects your phone to the board. A female DB-25 jack on the card's retaining bracket links the optional scanner to the system.

The MFAX96 hardware steals one COM port (COM1 or COM2) and DMA channel 1 from the host computer. If you

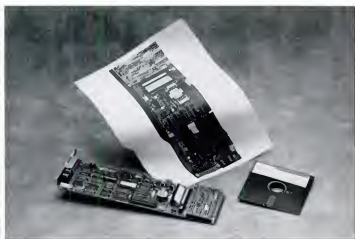
install a Microtek scanner, you'll also give up 15 contiguous system I/O ports nominally starting at 200 (hex) but selectable with a DIP switch.

The Microtek software is easy to use but offers limited functionality. It supports the features necessary for fax transmissions, printing results, and even (with the optional scanner) generates graphics fax images, but it does not let you preview images on your screen or edit them.

The principal Microtek program, Mfax, is a menu-driven system that operates purely in text mode and is thus compatible with any standard PC display system, even those lacking graphics capability. A single master menu, which occupies the left side of the screen even when submenus have been called up, unites all functions. To operate the system, you simply select functions and fill in the blanks with appropriate device- and file names.

The system divides its functions between submenus for sending, receiving, converting files, printing, scanning, scheduling calls, editing call schedules, and viewing a journal of system activity.

Mfax allows all the normal fax call options, including broadcasting, polling, and unattended operation. Unlike other sys-



The Microtek modem is a full-length expansion card, standard XT height, that uses the 8-bit XT data bus. The principal Microtek program is a menu-driven system that operates only in text mode and is compatible with any standard PC display.

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CIRCLE 183 ON READER SERVICE CARD

■ PCs AND FAX

terms that automatically handle multipage transmission using numbered file extensions. Mfax manipulates such transmissions by listing the filenames of individual pages. Theoretically, the system can handle an unlimited number of pages or documents in a single transmission.

The MFAX96 conversion function adapts WordStar or ASCII text files into graphics fax files. The documentation

PC MAGAZINE FACT FILE

Microtek MFAX96

Microtek Lab Inc.
16901 S. Western Ave.
Gardena, CA 90247
(213) 321-2121

List Price: \$995

Requires: 256K RAM, DOS 2.0 or later.
Hard disk recommended.

In Short: A PC-based fax system that includes a 9,600-bps modem and character-oriented software for sending, receiving, and printing fax transmission, but it lacks previewing and editing capabilities.

CIRCLE 66 ON READER SERVICE CARD

does not note that this conversion works only on a single graphics page (which, owing to its small typeface, amounts to about 2 pages of Pica type), leaving the rest of a text file unscathed.

Conversion in the other direction, from graphics to text, is possible using Microtek's EyeStar image processing/character recognition software. EyeStar is not supplied with MFAX96, however, but it comes with Microtek's MS-200A and MS-300A scanners, either of which is compatible with MFAX96.

The MFAX96 software has built-in drivers for three laser printers—AST TurboLaser, Cordata LP300, and Hewlett-Packard Laserjet/Laserjet Plus—as well as printers compatible with the Epson FX series 9-pin dot matrix graphics commands.

The biggest deficiency of the MFAX96 system is its lack of image viewing, previewing, and editing. But since scanner software performs this function, the company presumably chose not to duplicate the functions of its scanner support software here. That choice severely limits the application of MFAX96 as a standalone system: it doesn't eliminate paper but requires it.

PITNEY BOWES

Path II

The Pitney Bowes Path II system closely resembles the earlier version of EIT's pc-Fax system. According to a Pitney Bowes spokesman, EIT originally wrote the Path II software for the company under a non-exclusive contract that allows EIT to market the product. The version of Path II that matches EIT's current pc-Fax is not yet ready but will soon supersede the one examined here.

Although the Path II's present implementation lacks pc-Fax's spiffy pull-down menus, it does turn any PC into a fax machine with complete capabilities for sending, receiving, processing, and printing fax files and turning ordinary ASCII text into fax format.

The Path II hardware is based on EIT's fax modem and thus requires a full-length, XT-height, 8-bit bus expansion slot. The version received for review was equipped with a Hitachi high-speed modem chip set instead of the Rockwell chips on the pc-Fax modem. However, no difference in the hardware's operation was apparent. Path II connects to any RJ-11 phone cable and optionally links to a desk telephone. To the host computer, it acts like COM1 or

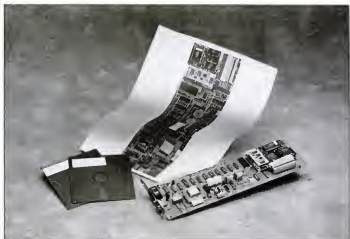
COM2, and is jumper selectable.

Besides the features of the EIT card, the Pitney Bowes modem board provides an additional 9-pin connector that allows you to attach a Pitney Bowes 8100 fax machine directly to your PC. That link-up allows your equipment to function as Pitney Bowes's earlier Path I system. The fax machine is used as an input/output device with the PC in control, much like Xerox's FaxMaster (see below).

The software that operates the fax modem is rudimentary but effective. The principal control program, Faxmenu, is a menu, drawn using DOS's ANSI.SYS driver, that allows you to select functions with number keys. With the appropriate selections, you can handle any normal fax operation, such as automatically sending and receiving transmissions, broadcasting, and polling.

The Path II system can be operated directly in real time or unattended to take advantage of the after-11 P.M. telephone rates. It will send and receive individual documents up to 99 pages long and can dispatch them to or garner them from a number of remote machines limited only by the time available for calling.

The Path II software lets you convert files between several formats and includes



Pitney Bowes Path II hardware is based on EIT's fax modem and requires a full-length, XT-height, 8-bit bus expansion slot. The Faxmenu software allows you to handle any normal fax operation, like automatically sending and receiving transmissions, broadcasting, and polling.



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■ PCs AND FAX



FACT FILE

Path II

Pitney Bowes
Facsimile Systems
Walter H. Wheeler, Jr., Dr.
Stamford, CT 06926
(800) MR-BOWES, ext. 348

List Price: \$2,795

Requires: 256K RAM, graphics adapter,
DOS 2.0 or later.

In Short: A complete system, including a
9,600-bps modem, that converts any PC into
a fax machine with file conversion and auto-
matic sending and receiving capabilities.

CIRCLE 88 ON READER SERVICE CARD

the expected ASCII-to-fax and file compression abilities. Pitney Bowes also supplies OCR software (based on the EIT program) that can read fax text into standard ASCII format. As with the EIT software, the Pitney Bowes product recognizes only four different type fonts.

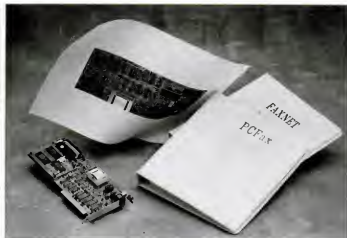
Path II limits your image editing abilities to cropping and merging. You can display the resulting output on most graphics-capable screens, send it to another fax machine, or print it locally using one of a wide variety of printers, including dot matrix printers made by Brother, C. Itoh, Epson, Fujitsu, IBM, and the QMS SmartWriter. The Pitney Bowes system supports the IBM CGA, Hercules graphics, Tecmar Graphics Master, and Genius VHR video graphics standards.

SCICOM COMPUTER CONSULTANTS

FaxNet

FaxNet, a pure-software product from Scicom Computer Consultants, works like an independent version of Xerox's *FaxMaster* but with enhanced editing abilities. Since it doesn't include a modem, it lacks communications capabilities. The *FaxNet* system links together a PC, a fax machine or scanner, and, optionally, a printer to make a graphics storage and retrieval system based on the international Group 3 fax standard.

With *FaxNet*, your PC can store, display, and edit both text and graphics in fax



Scicom's *FaxNet* is a pure software product that links together a PC, a fax machine or scanner, and, optionally, a printer to make a graphics storage and retrieval system based on the international Group 3 fax standard. Scicom's *PCFax* system is an enhancement of the Gamma Technology hardware. It differs chiefly in its display techniques and its hooks to support graphics editors.

format using editors such as *Halo DPE* (Document Processing Editor), which is supplied optionally by Scicom, or *PC Paintbrush*.

FaxNet requires that both your PC and fax machine or scanner have a serial port. Compatible imaging devices include the Xerox 295 telecopier, the Ricoh R2100 fax machine, and the Canon IX-12 image scanner.

Once the graphics information is transferred from scanner to PC, it can be displayed on any graphics monitor compatible with the following standards: IBM CGA and EGA, Hercules Graphics, Tecmar Graphics Master, AT&T DEB (for AT&T and Xerox PCs), and the Genius VHR full-page monitor. You can print edited or unedited images using dot matrix printers such as the Epson FX-series or the Okidata 92/93, as well as the Xerox 4045 and the Hewlett-Packard Laserjet Plus laser printers. You can also send images to the attached fax machine.

The *FaxNet* package consists of several programs, each fulfilling a single purpose. Scanin is a command-driven utility that captures images from the attached fax machine. Command-line options allow

changing densities, compensating for light images, and compressing images into fax format. DISP displays the captured image; does rough editing (such as rotating the image or changing the display color); converts file formats between *Halo DPE*, bit-mapped, Xerox canvas, screen dump, or compressed fax formats; and sends the result to the attached printer. Limited menu help is available during editing. You can use the optional free-standing *Halo DPE*



FACT FILE

FaxNet

Scicom Computer Consultants
475 El Camino Real, #305
Millbrae, CA 94030
(415) 692-2050

List Price: \$695 with full editing (*Halo DPE*); without *DPE*, \$595.

Requires: 640K RAM, serial port, graphics adapter, DOS 2.0 or later. Hard disk recommended.

In Short: A system that links a PC to a fax machine for image editing and manipulation with minimal communications support.

CIRCLE 87 ON READER SERVICE CARD

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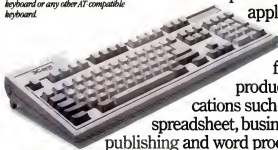
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WORKGROUP SYSTEMS



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■ PCs AND FAX

program for fine editing. Another *FaxNet* program, *Send*, which is also command driven, outputs the finished work back to the fax machine.

SCITCOM COMPUTER CONSULTANTS

PCFax

Scicom's PCFax system is not so much based on GammaFax as it is an enhancement of the Gamma Technology system. It differs chiefly in two areas: its display techniques and its hooks to support graphics editors. The hardware used by the two systems is identical, however—the GammaLink fax modem.

Based on the Rockwell 9,600-bit-per-second modem chip set, the 10-inch-long GammaLink board requires a full XT-height, 8-bit expansion slot. The auto-dialing, auto-answering 9,600-bps modem is fully compatible with the Group 3 digital fax standard.

As is the case with the GammaLink product, PCFax will also handle PC-to-PC binary file transfers at rates up to 9,600 bps downgraded to 4,800 bps when a PC is party to the transfer because of the processing load imposed by the error-correction protocol.

PCFax has full fax communications control abilities. It will automatically send and receive fax images, poll remote machines, and store the results on a DOS floppy or hard disk. It can be used as an image database and as a store-and-forward system. The system can also convert ASCII

files into fax files for transmission. *Halo DPE* (Document Processing Editor) is included with the package for editing images. The system can incorporate fax images into *Ventura Publisher*, and Scicom is currently working on compatibility in the other direction.

The PCFax uses the same control scheme and utilities as does GammaFax. It has a menu-driven front end to help you get started with fax, but full command-driven operation (complete with batch capabilities) is always available. It will also maintain a log file.

PCFax requires that you have a graphics-compatible display based on one of the following display standards: EGA (color or monochrome), CGA, Hercules graphics, or Genius VHR. It will generate printouts on Epson or IBM 9-pin dot matrix printers and will scan images using the Canon IX-12 image scanner (in addition to receiving fax images across its phone line input).

XEROX CORP.

FaxMaster

FaxMaster is Xerox Corp.'s software for linking its 495-I fax machine with a PC through an RS-232 port, and it is representative of such products available from suppliers of office equipment.

Written in QuickBASIC, *FaxMaster* takes complete control of its host computer, which must devote its time to fax. The program operates principally as a command center for the 495-I fax machine, allowing you to schedule outgoing transmissions and to automatically receive documents. Anything scanned by the 495-I can be stored on the hard disk of the host PC (each fax file requires, on the average, 50K bytes of disk space) and displayed on its monitor. The system is compatible with only the Xerox high-resolution display and the IBM EGA standard.

The tone detection circuits of the 495-I give *FaxMaster* remote control abilities. Using a DTMF (Dual Tone Modulated Frequency) or Touch-tone phone and a fax machine, you can dial directly into the *FaxMaster* system and download any document in its library. It even remotely prints out a command menu should you forget

what to do. Of course, access to filed documents and these remote functions can be access-protected with passwords. The system will also maintain a log of all its activities.



FACT FILE

FaxMaster

Xerox Corp.
Xerox Sq. 05A
Rochester, NY 14644
(716) 423-3529

List Price: *FaxMaster*, \$695; telecopier 495-I, including serial option, \$5,955.

Requires: 256K RAM, hard disk, DOS 2.1 or later.

In Short: An easy-to-use software product that links a 495-I fax machine with your PC. Not copy protected.

CIRCLE 666 ON READER SERVICE CARD

The same techniques are used to make a fax-oriented electronic mail system so that important messages and other images can be routed automatically to the proper persons (or at least to their fax machines) no matter where they might be.

FaxMaster also has built-in abilities to convert ASCII text into fax-compatible documents. Although it does not have its own text or document editor, it is compatible with *Halo DPE* (Document Processing Editor), and text files can be created with any word processor that can generate an ordinary ASCII file.

Completely menu-driven, the *FaxMaster* software is easy enough to use so that anyone with even the least amount of PC experience should be able to take advantage of its capabilities within a few minutes of opening the box.

The primary drawback of the system is that it requires you to have a Xerox fax machine, and at about \$4,195 for the 7020 and an additional \$300 or so for the serial option, the cost certainly does add up. If you already have a Xerox 495-I or are planning to buy a 7020 anyway, however, the increased versatility gained by adding *FaxMaster* makes the program well worth its expense.

Winn. L. Rosch is a contributing editor of PC Magazine.



FACT FILE

PCFax

Scicom Computer Consultants
475 El Camino Real, #305
Millbrae, CA 94030
(415) 692-2050

List Price: \$1,995

Requires: 256K RAM, graphics adapter, DOS 2.0 or later. Hard disk recommended.

In Short: A complete system, including a 9,600 bps modem, that converts any PC into a fax machine with file conversion and automatic sending and receiving capabilities.

CIRCLE 666 ON READER SERVICE CARD

A Chip off the Ol' Blue.

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THE BEST of the BEST UTILITIES

When IBM rolled out the PC, no one imagined you'd ever want to print a spreadsheet 600 characters wide, permanently sort a subdirectory by file extension, attach an electronic Post-it to a database record, recover an accidentally erased file, dial a phone number from your screen, or add color to the otherwise bland 1-2-3 running on your color monitor.

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Looking for personal recommendations to expand your PC's bag of tricks? Our editors, contributing editors, and frequent contributors rave about their nominations for the most useful utilities. Power users all, they tell you which handy little tools they can't do without.

■ UTILITIES

software from a bulletin board, you don't get the equivalent of the safety seal Tylenol puts around its bottle caps. You run a slight risk of a rogue program trashing your hard disk.

Of course, one good source of free utilities is *PC Magazine*. Our Interactive Reader Service makes available some three-dozen-plus utilities to accomplish a wide range of useful tasks: browse through files, change file attributes, execute commands across every subdirectory, set printer control codes from within programs, and so forth. These *PC Magazine Utilities* (described in Volume 6 Number 4, page 176) also are available on a disk if you subscribe or renew your subscription to the magazine and recently were made available to user groups and bulletin boards for noncommercial use.

Any list of best utilities such as this one is highly subjective, and subject to the changing needs of users. For instance, 3 years ago no power user could be without *Xenocopy*, a utility that allowed PCs to read disks created on CP/M machines. Now *Xenocopy* mostly is a memory because CP/M, for all practical purposes, is, too. If you want a translation utility today, you're probably more interested in converting between MS-DOS word processor formats, for instance *WordStar* to *WordPerfect*, preserving the margins, underlining, and boldfacing.

Some of the utilities cited on the following pages are household words, such as *SideKick* and *The Norton Utilities*. Others aren't—just yet. Consider, for instance, the *Mace Utilities*. While everyone who ever has popped a disk in a PC knows *Norton* lets you recover an erased file, how many know that *Mace* lets you recover files from an accidentally formatted hard disk?

On the whole, these utilities provide an array of tantalizing options that let you work faster, better, and smarter. Utilities are reviewed in alphabetical order (by product name).

Outraged readers and utility publishers whose favorites aren't included here should feel free to write to *PC Magazine* and sing the praises of other utility programs—after all, we're always looking for personal recommendations too.

—Bill Howard

OUR REVIEWERS

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ARC, Version 5.1

File compression for efficient transmission across phone lines.

Ask any advertising executive what's the best form of advertising and she'll undoubtedly say, "Word of mouth, of course." A good product is recommended because it makes sense. The high-tech version of word of mouth lately has been the electronic bulletin board, and its grassroots wisdom has brought us some rewards: first *Qmodem* and *PC-Talk*, later *ProComm*, and now *ARC*.

ARC, by System Enhancements Associates, is designed to store a group of files within one file. During the archival process it compresses the files to use the minimum amount of storage space, so the *ARCed* file is smaller than the original group. The reason *ARC* is so popular on bulletin boards is that it allows more than one file to be transferred across phone lines at once, thus reducing the amount of time spent on the telephone.

Before storing, *ARC* will examine the file and use one of four storage methods to

■ Utilities provide tantalizing options that help you work faster, better, and smarter.

reduce it to its smallest possible size. The utility is versatile and flexible—it allows you to add or delete files, extract, copy, list, run, and test the archive integrity. Although *ARC* makes no specific claims about how much space you will save, we averaged a 45 percent reduction on the files we tested, which were a combination of ASCII text, *dBASE* files, and *.COM* utility files.

ARC is "shareware," which means that although you will find this useful utility on thousands of bulletin boards (including the *PC Magazine* Interactive Reader Service), you are expected to make a contribution to the developer. If you buy *ARC*

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Freeware or shareware programs may not run as quickly as commercial programs and may have more cryptic user interfaces, but the prices are right. Yet it's a good idea to be sure of the source before you use one of these programs. When you download

Looking for personal recommendations to expand your PC's bag of tricks? Our editors, contributing editors, and frequent contributors rave about their nominations for the most useful utilities. Power users all, they tell you which handy little tools they can't do without.

■ UTILITIES

software from a bulletin board, you don't get the equivalent of the safety seal Tylenol puts around its bottle caps. You run a slight risk of a rogue program trashing your hard disk.

Of course, one good source of free utilities is *PC Magazine*. Our Interactive Reader Service makes available some three-dozen-plus utilities to accomplish a wide range of useful tasks: browse through files, change file attributes, execute commands across every subdirectory, set printer control codes from within programs, and so forth. These *PC Magazine Utilities* (described in Volume 6 Number 4, page 176) also are available on a disk if you subscribe or renew your subscription to the magazine and recently were made available to user groups and bulletin boards for noncommercial use.

Any list of best utilities such as this one is highly subjective, and subject to the changing needs of users. For instance, 3 years ago no power user could be without *Xenocopy*, a utility that allowed PCs to read disks created on CP/M machines. Now *Xenocopy* mostly is a memory because CP/M, for all practical purposes, is, too. If you want a translation utility today, you're probably more interested in converting between MS-DOS word processor formats, for instance *WordStar* to *WordPerfect*, preserving the margins, underlining, and boldfacing.

Some of the utilities cited on the following pages are household words, such as *SideKick* and *The Norton Utilities*. Others aren't—just yet. Consider, for instance, the *Mace Utilities*. While everyone who ever has popped a disk in a PC knows *Norton* lets you recover an erased file, how many know that *Mace* lets you recover files from an accidentally formatted hard disk?

On the whole, these utilities provide an array of tantalizing options that let you work faster, better, and smarter. Utilities are reviewed in alphabetical order (by product name).

Outraged readers and utility publishers whose favorites aren't included here should feel free to write to *PC Magazine* and sing the praises of other utility programs—after all, we're always looking for personal recommendations too.

—Bill Howard

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ARC, Version 5.1

File compression for efficient transmission across phone lines.

Ask any advertising executive what's the best form of advertising and she'll undoubtedly say, "Word of mouth, of course." A good product is recommended because it makes sense. The high-tech version of word of mouth lately has been the electronic bulletin board, and its grassroots wisdom has brought us some rewards: first *Qmodem* and *PC-Talk*, later *ProComm*, and now *ARC*.

ARC, by System Enhancements Associates, is designed to store a group of files within one file. During the archival process it compresses the files to use the minimum amount of storage space, so the *ARCed* file is smaller than the original group. The reason *ARC* is so popular on bulletin boards is that it allows more than one file to be transferred across phone lines at once, thus reducing the amount of time spent on the telephone.

Before storing, *ARC* will examine the file and use one of four storage methods to

■ Utilities provide tantalizing options that help you work faster, better, and smarter.

reduce it to its smallest possible size. The utility is versatile and flexible—it allows you to add or delete files, extract, copy, list, run, and test the archive integrity. Although *ARC* makes no specific claims about how much space you will save, we averaged a 45 percent reduction on the files we tested, which were a combination of ASCII text, *dBASE* files, and *.COM* utility files.

ARC is "shareware," which means that although you will find this useful utility on thousands of bulletin boards (including the *PC Magazine* Interactive Reader Service), you are expected to make a contribution to the developer. If you buy *ARC*

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directly from its owner, System Enhancements Associates, you will receive for \$50 a number of helpful utilities along with a printed copy of the ARC documentation. —Christopher Barr

Brooklyn Bridge

Link laptops to desktops for easy file transfers between 5¼- and 3½-inch disks.

This is one of those rare programs that you enjoy the minute you take it out of the box, especially when you discover that a cable is included. *Brooklyn Bridge* (\$129.95), by White Crane Systems, lets you link two MS-DOS computers via the serial ports in such a way that one machine is a slave (actually a file server) to the other. It's specifically designed to hook a portable such as the Zenith, NEC, or Toshiba to a desktop system. The active machine, which can be the portable or the desktop, uses the disk drives of the slave machine as though they were logical drives on the active machine. In other words, when I hook my Zenith 181 to my PC AT and make the AT the slave, I suddenly have a 5¼-inch floppy disk and a hard disk, which become drives C: and E, respectively (drive D: being the second floppy disk, if I had one). Drives A: and B: are on the Z-181. I can transfer files to and from either machine and even load and run programs into the Z-181 from the PC AT.

With the laptop market heating up, *Brooklyn Bridge* has a half-dozen competitors. Most prominent is Traveling Software's *Laplink* (\$129.95), which NEC also sells with its *MultiSpeed* laptop as its "serial transfer kit."

With *Brooklyn Bridge* you can even turn the portable into a slave, load your communications program on your desktop, and send files from the 3½-inch disks on the portable via the modem in the PC. This actually is a mininetwork that runs at 115K bits per second.

Installation is simple. You install a device driver into your CONFIG.SYS files on both machines. (The package is supplied with both a 5¼-inch and a 3½-inch diskette, each containing the device driver and program.) When you want to link machines you hook up the cables and run a

simple program that turns on the network. The second computer then is booted, and it "sees" the link program, makes the connection, and becomes the master unit. Otherwise, the device driver disables itself and doesn't interfere with the normal workings of the serial port. Excellent product. —John C. Dvorak

Disk Optimizer

Increase your disk speed significantly by rearranging data into contiguous clusters.

Faster disk performance—that's what *Disk Optimizer* (\$59.95), from SoftLogic Solutions, promises for nearly any heavily used hard disk system. The software utility simply rearranges the data on your hard disk so you can get at it more quickly.

If you've used your hard disk for any length of time, odds are that it's become slower. The problem is not due to aging components but to how DOS functions. Information is written on disks in blocks called clusters that are not necessarily contiguous.

When a disk is new, the first few files are written contiguously (all in sequence next to one another on the disk); as items are erased or edited, however, blank areas may appear in the midst of the disk sections used. DOS, in search of space-saving efficiency, fills in those holes. As a result, the read/write head in the disk drive may need to jog between dozens of different tracks on the disk just to read one file, and each jog can add appreciably to the time required to read a file. Although this extra effort may add only a fraction of a second to disk reading time, it is perceptible and—if you are a power user—bothersome.

The solution *Disk Optimizer* delivers is simply to rearrange the data on the disk so that all files are made from contiguous clusters. By temporarily moving clusters to a free space on the disk, it frees up blocks of contiguous clusters to which it then restores the data. It's a simple and efficient method that leaves your disk organized like new.

The program also includes an analysis function, which helps determine when such a reorganization is advantageous; a file security system, which locks files so

others cannot pry into them; and a byte editor, which allows you to modify any byte anywhere on your disk more quickly and conveniently than with DOS's DEBUG.

Disk Optimizer includes a well-written, typeset manual that's very clear; even novices should have no problem with the program. The only limitation of the utility is that it cannot handle subdirectories more than 30 levels deep. In practice, that should prove no limitation at all.

—Winn L. Rosch

DOS2ools

X-Tree

Extend the power and reduce the complexity of DOS.

Since none of the so-called DOS shells are perfect for every situation, I use two of them—E-X-E Software Systems' *DOS2ools* (\$99) and Executive Systems' *X-Tree* (\$49.95)—virtually every day. Some people may sneer at DOS shells in the mistaken belief that they are for novices. The true power user, though, knows that productivity increases when you have tools at your disposal. And programs such as *DOS2ools* and *X-Tree* are just that—productivity tools.

PC-DOS may satisfy the needs of the one-task user, but it falls short when your hard disk's structure has all the solidity of molten lava. The hard disk I work on may have two subdirectories one day and 20 the next. It could be at my home (where I know the location of every file) or in PC Labs (where executing DIR is like opening a grab bag). As a consequence, I use *DOS2ools* and *X-Tree* as often as I do a word processor.

DOS2ools is the most complete set of intelligent utilities I've ever encountered. *DOS2ools*'s 43 programs can be run from the DOS prompt or from a shell that provides a common interface. They include: Where, to locate files; Move, to transfer files between subdirectories; macros; and disk drive, system, and directory status information. With them, I find and move files anywhere on my hard disk, I extend my path so *WordStar* won't go looking for the A: drive, and I inspect program file contents with a minimum of fuss. Because each utility is a stand-

Boost cursor speed. Stop cursor run-on.

With all the recent hoopla over performance, it's ironic that two of the PC's ergonomic deficiencies have been overlooked — its slow cursor, and the tendency of the cursor to remain in motion (run-on) after a cursor key has been released. Finally, the solution — **Cruise Control™** from Revolution Software.

Cruise Control is a new productivity tool for serious PC users. It boosts cursor speed, typically by 3-5X. It eliminates annoying cursor run-on. And it adds hands-free cursor navigation to any application.

If you use 1-2-3, Symphony, dBASE, Reflex, or Paradox, you need Cruise Control's Anti-Skid Braking. Here's what the leader of one Lotus users group said about Cruise Control:

"Once I used it, I wanted it! Excellent idea. Very practical. One of the best programs ever sent to us for review!"

If you use Word Perfect, MS-Word, Q&A, DisplayWrite, MultiMate, WordStar 2000, Framework, PC-Write, or SideKick, you need Cruise Control's Screen Runner, the high-performance, adjustable-speed cursor.

Cruise Control's namesake feature takes the drudgery out of paging through data base records, long documents, and large spreadsheets. It lets you repeat any key, hands-free — at the speed of your choice.

And there's more. A Chronometer "types" the time or date into your application at the current cursor position. The keyboard-controlled Screen Dimmer protects your privacy. The programmable Auto-Dimmer extends the life of your display screen.

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Dept. 110

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alone, I keep the few I use on my work-in-progress floppy disk so they are available even when I'm at PC Magazine.

I use *X-Tree* whenever I begin and finish a new project or work with a floppy disk. Because *X-Tree* has a visual tree interface, it lets me wipe out or build an entire hard disk structure without having to work in the dark. With its ShowALL window and tag facility, I can manipulate any number of files in a fraction of the time it would take with DOS.

DOS2tools and *X-Tree* are indispensable to my efficiency. If their features interest you, take a look at them and also consider their competitors: Keep It Simple Software's *dirWORKS* (\$25); WindowDOS Associates's *WindowDOS* (\$49.95); Micro-Z's *The Direc-Tree Plus* (\$49.50); or any of the other programs we reviewed in "DOS Shells Get Smarter," (*PC Magazine*, Volume 6 Number 4).—**Vincent Puglia**

Fansi-Console

One-stop shopping for keyboard and screen enhancements.

Many serious PC users have a gaggle of separate utilities to enhance their keyboard and screen. Hersey Micro Consulting's *Fansi-Console* (\$75) is a unified alternative. Not only does it have too many features for all of them to be summarized here, but it does what it is supposed to do extremely well.

The name *Fansi* is a contraction of "fast ANSI." It extends and replaces the standard ANSI.SYS device driver and scrolls text at speeds six times that of the normal screen driver!

It allows scrolling without flickering or snow on the CGA. It has scroll recall, which can recover material that has rolled off the screen from most programs and lets you use EMS memory for it. It allows safe, automatic screen-blanking on most monitors, as well as on EGA and Hercules cards.

Fansi can add color to many graphics programs that insist on running in black and white, speed up your cursor and stop on a dime, and enlarge the type-ahead buffer. While its macros are no replacement for *SuperKey* or *Keyworks*, they are

a vast improvement over ANSI.SYS.

There are drawbacks. On an EGA it takes almost 40K of RAM, and the manual is written in ANSI-speak rather than English. But all in all, I'm a *Fansi* fan.—**Barry Simon**

File Facility

Navigate the subdirectory maze and access files in a flash.

DOS has some problems negotiating its own paths and subdirectories. Nothing solves these problems better than the \$19.95 *File Facility*. Also known as *Filefac*, this program is part of IBM's Personally Developed Software (PDS) series: low-cost programs written by IBM employees.

Filefac is so trouble-free that I've had it running on all my systems since some time in 1984. It's part of my standard AUTOEXEC.BAT, and I wouldn't dream of being without it. *Filefac* is a small (less than 2K) RAM-resident program that for all intents and purposes becomes part of DOS and assists it in opening files across subdirectories.

DOS needs this kind of help because many older programs don't know how to search for their own overlays. *WordStar* (pre-4.0) is a perfect example—it doesn't know the first thing about subdirectories. *WordStar* users, unless they know the tricks, are forced to have copies of its overlays in every subdirectory in which they edit files. DOS knows how to search the path you give it in the PATH command for .COM, .EXE, and .BAT files, but it has no idea of how to find overlays and help files.

Filefac solves the problem by intercepting all open-file calls and searching the current path for all files. You can quickly change the paths that *Filefac* searches by issuing new PATH commands from batch files as you move from one application to another. *Filefac* also knows how to use an environment variable for its search path, which allows you to have two paths active at once.

The downfall of some of path-extending programs is that they will create as well as open files along the path. That's a mixed blessing, and a frequent cause of

■ UTILITIES

problems if you don't know what you're doing. You wind up creating files in unexpected directories and overwriting files you thought were safe. *Filefac* can create files if you really want it to, but its defaults assume that you don't.

The hardest thing about *Filefac* may be buying it. IBM has never marketed the PDS series particularly well, and most dealers have never heard of it. Call IBM Personally Developed Software (a distributor for such IBM software) at (800) IBM-PCSW for a copy of their current software directory. —Bill Machrone

Hot Line

This intelligent phone dialer already comes with an extensive directory.

Give away razors, sell razor blades. It worked for Gillette, and it could be a smash hit for General Information, whose brand-new *Hot Line* is the hands-down best phone dialer you'll ever see.

The \$29.95 memory-resident utility combines a super-intelligent dialer with a directory of America's top companies, colleges, and government agencies. That's where the sell-razor-blades part comes in: General Information bought the National Directory of Addresses and Telephone Numbers and plans to sell the listings electronically. *Hot Line* includes 2,078 listings; the *National Directory* has 150,000-plus, which amounts to nearly 10 megabytes' worth before addresses or zip codes. So perhaps there is a CD-ROM in your future.

Hot Line has every feature you could want in an auto-dialer:

- *Hot Line* ignores the area code on local numbers, but adds 1 before numbers that are toll calls to the far reaches of your area code.
- It can include a 9 to get an outside line.
- You can build in pauses to account for sluggish phone systems or insert a calling card number.
- *Hot Line* has a look-up table of area codes for every state, major city, and even many small towns and suburbs.

To dial a number, call *Hot Line* with Alt-F10, pick the directory, then type in the first letters of the name. *Hot Line* finds the closest match; if it's off, scroll

up or down the directory, then hit Enter to dial. You can keep a log of each call; there is a speed call option.

Any database, spreadsheet, or word processor list can be converted, so

there's no rekeying. The conversion process even tacks on the local time zone.

Hot Line lacks only an effortless method of adding listings a handful at a time. You have to decompile the entire list to a

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text file, key in the new names and numbers, then recompile.

Hot Line works well with most major word processors and spreadsheets, although it may quarrel with another communications program over access to the modem port. —**Bill Howard**

KBFIK2

NoBlink/Accelerator

Gain total control over cursor speed and stop that annoying blink.

There's no truth to the story that IBM invented the blinking cursor as a psychological weapon for the CIA, but sometimes you wonder. A flashing light induces tension. And the PC's cursor makes it worse by moving across the screen at a frustrating crawl. Yet IBM brainwashes people into thinking they couldn't bear to have it any other way.

NoBlink/Accelerator (\$49.95) from Nostradamus beats cursors into ploughshares. It turns the nervous underline into a soothing and steady block and offers three vigorous speeds for cursor movement. You can toggle the blinking and set the speed within an application, and the program works with every application I know. Some programs offer a nonblinking cursor as an option, but for everything else, especially your sanity, you need *NoBlink*.

For even more sanity, combine *NoBlink* with Skip Gilbrech's public-domain wonder, *KBFIK2*, Version 3.0. This adds further speed and refinement to cursor movement, enlarges the keyboard buffer, adds visual or aural indicators for the toggle keys, makes ScrollLock lock the scroll, and makes CapsLock logical. All its features are optional and can be toggled, adjusted, or suppressed. And the price is right.

What about the \$29.95 *Cruise Control* (Revolution Software, Randolph, N.J.), *KBFIK2*'s better-known commercial rival? It lets you repeat a key without holding it down, but I find it's more trouble than it's worth. (Not everyone agrees; some people swear by *Cruise Control*.) Moreover, it can't be turned off unless you turn off the whole program, and you have to adjust *Cruise Control*

when you open a new application.

—**Edward Mendelson**

Lightning

Speed up data retrieval with this RAM-resident disk-caching utility.

Personal Computer Support Group's *Lightning* (not to be confused with Borland's *Turbo Lightning*) is an \$89.95 RAM-resident disk-caching program that, although it takes a slower approach than some of its competitors, can help speed up data retrieval. When you first access a disk, cache software like *Lightning* stores the data in an otherwise unused hunk of RAM. When you need that data again, the software retrieves it from memory rather than from disk. Result: a notable speedup, particularly with programs like *WordStar* that use overlay files and databases that reuse the same data repeatedly. The slower the disk, the greater the improvement.

Yet my friend the mainframer scoffs at the idea of disk caching. "I'll use a disk cache when IBM writes one," he snorts. "They should be called disk 'caches'—as in Catch-22." He has a point: much caching software leaves updated data in RAM for a bit, instead of writing it immediately to the safety of a disk. If that data includes a file allocation table or a disk directory and your PC or program crashes, you're likely to desperately try to reconstruct your entire hard or floppy disk.

Lightning takes a more conservative approach, writing all changed data to disk instantly. That's slower than other methods, but a whole lot safer. *Lightning* uses up to about 1800K of expanded memory, so it needn't eat up much of your 640K of DOS-accessible RAM. It can cache all of your disk drives or some of them. Once the program's in your AUTOEXEC.BAT, you can forget it's there.

Lightning has been absolutely dependable in the year and a half that I've used it daily with a wide variety of RAM-resident software. Similar programs, including public domain cheapies, claim flashier performance. But I'm satisfied enough with *Lightning* to not even consider switching. —**Stephen Manes**

LIST

A fast, painless, multidirectional file search utility.

Stop. If you have \$15 handy, sit down right now and send a check to Vernon D. Buerg for his sensational LIST.COM. If you're broke, go out and give blood. You won't regret it.

Like Charlie Petzold's power-packed BROWSE.COM (PC Magazine Utilities Disk), *LIST* scans forward, backward, or sideways through files. But *LIST* can also display related groups of files. And it can page through redirected output (from a DIR listing, for instance).

Buerg has made the program astonishingly powerful and easy to use. It searches for text, filters out screen-jangling junk, cleans up *WordStar* files, and displays files in DEBUG-like hex format, or split the screen horizontally to compare two chunks of text. The program lets you change colors on the fly, SHELL to DOS and back, and—get this—toggle between 25 and 43 lines on an EGA.

LIST displays a wealth of information about its current settings and the file it's scanning. Buerg provides solid documentation (in LIST.DOC) and shows how to patch toggles using DEBUG. But he also lets users fiddle with the settings and then clone a brand new copy with the current customizations as the default.

Too bad most commercial software isn't as powerful, friendly, smart, feature-rich, and inexpensive as *LIST*. .COM. Get it. —**Paul Somerson**

Mace Utilities

Restore files—even if you've reformatted your hard disk.

The only serious competition to *The Norton Utilities* is Paul Mace's \$99 *Mace Utilities*, Version 4.0. Both undelete files (the real reason most users probably buy a package like this). Mace's programs lack Norton's helpful hard disk management tools, but they'll kick your performance up a bit by unfragmenting choppy files and streamlining PATH searches, and they do a more earnest job patching together files from damaged disks.



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William Wong, PC Labs

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DESKTOP UTILITIES



Hot Line
General Information Inc.
401 Park Pl., #305
Kirkland, WA 98033
(800) 722-3244
(206) 828-4777
List Price: \$29.95

Requires: 256K RAM,
one disk drive, DOS 2.0 or later.
In Short: An intelligent, memory-resident electronic phone book and auto dialer. Allows you to transfer files from existing electronic listings easily. Not copy protected.

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PC-12C
Popular Programs Inc.
135 Lake St., #180
Kirkland, WA 98033
(800) 44-POPUP
(206) 822-7065
List Price: \$99

Requires: 128K RAM,
one disk drive, DOS 2.0 or later.
In Short: The PC-12C is an excellent pop-up emulator of the popular HP12C scientific calculator. Not copy protected.

CIRCLE 604 ON READER SERVICE CARD



SideKick
Borland International
Inc.
4585 Scotts Valley Dr.
Scotts Valley, CA 95066
(800) 255-8008
(800) 742-1133 (in Calif.)

List Price: \$54.95 with copy protection;
\$84.95 without.
Requires: One disk drive, DOS 2.0 or later.
In Short: A handy RAM-resident electronic version of five common desk accessories: calculator, notepad, dialer, calendar, and ASCII table. Available with or without copy protection.

CIRCLE 606 ON READER SERVICE CARD



Smart Notes
Personics Corp.
2352 Main St.
Concord, MA 01742
(800) 445-3311
(617) 897-1575
List Price: \$79.95

Requires: 128K RAM,
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In Short: RAM-resident. An ideal way to annotate your electronic files. Not copy protected.

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DOS UTILITIES



DOS2tools
E-X-E Software Systems
8855 Atlanta, #298
Huntington Beach, CA
92646
(714) 662-2535
List Price: \$99

Requires: 128K RAM,
one disk drive, DOS 2.0 or later.
In Short: An incredibly intelligent and useful collection of utilities that make DOS's power easy to access. Not copy protected.

CIRCLE 603 ON READER SERVICE CARD



File Facility
IBM Personality Development Software
P.O. Box 3280
Wallingford, CT 06494
(800) IBM-PCSW
List Price: \$19.95

Requires: One disk
drive, DOS 2.0 or later.
In Short: An indispensable program for helping DOS and many programs negotiate sub-directories. Not copy protected.

CIRCLE 602 ON READER SERVICE CARD

LIST

Vernon D. Buerg
456 Lakeshire Dr.
Daly City, CA 94015
(415) 994-2944 (VOR 24-hour BBS)
List Price: \$15 registration fee.
Requires: 66K RAM (96K RAM to use the DOS shell; 9K RAM more to save screens), one disk drive, DOS 3.0 or later (DOS 3.0 or later for file sharing).
In Short: If you want to try one piece of shareware, this is it. Incredibly powerful, smart, easy and useful. Not copy-protected.

CIRCLE 648 ON READER SERVICE CARD

PCED

The Cove Software Group
P.O. Box 1072
Columbia, MD 21044
(301) 992-9371
List Price: \$38
Requires: 25K RAM, one disk drive,
DOS 2.0 or later.
In Short: This DOS command line editor has a powerful synonym feature and add-in utilities, useful for anyone who spends much time at the DOS prompt. Not copy-protected.

CIRCLE 650 ON READER SERVICE CARD



TailScreen
Qualitas, Inc.
8314 Thoreau Dr.
Bethesda, MD 20817
(301) 469-8848
List Price: \$49.95
Requires: 128K RAM,
one disk drive, DOS 2.0

or later.
In Short: A RAM-resident DOS utility that proves how limited DOS by itself really is. Not copy protected.

CIRCLE 649 ON READER SERVICE CARD

XRAY.COM

John F. Ferguson
6108 Earnshaw
Shawnee, KS 66216
(913) 268-6436
List Price: \$20 registration fee.
Requires: 15K RAM, DOS 2.0 or later.
In Short: A memory-resident debugging tool with split-screen display management that provides real-time windows of any memory address. Not copy-protected.

CIRCLE 647 ON READER SERVICE CARD



X-Tree
Executive Systems, Inc.
15300 Ventura Blvd.,
#305
Sherman Oaks, CA
91403
(800) 634-5545
(800) 551-5353 (in

Calif.)
(818) 990-3457
List Price: \$49.95
Requires: 192K RAM, one disk drive, DOS
2.1 or later.

In Short: The best way to generate a visual tree diagram of the directories and subdirectories on your hard disk. Not copy protected.

CIRCLE 651 ON READER SERVICE CARD

FILE COMPRESSION

ARC, Version 5.1

System Enhancement Associates

21 New St.

Wayne, NJ 07470

(201) 694-4710

List Price: \$50, includes disk with additional utilities, printed documentation; \$35, commercial site license.

Requires: 128K RAM, one disk drive, DOS 2.0 or later.

In Short: ARC is a handy utility used to archive a group of files into a single, compressed file. Not copy protected.

CIRCLE 640 ON READER SERVICE CARD



SQZ!

Turner Hall Publishing

10201 Torte Ave.

Cupertino, CA 95014

(408) 253-9607

List Price: \$79.95

Requires: 1-2.3, Symphony, or VP Planner,

DOS 2.0 or later.

In Short: A RAM-resident utility that compacts the size of spreadsheet files to about 20 percent of their original size. Not copy protected.

CIRCLE 640 ON READER SERVICE CARD

XEQ.COM, Version 1.01

Colin Stearns

Hardwood Software Associates

43 Ash St.

Hopkinton, MA 01748

List Price: Free, from any bulletin board or disk library.

Requires: DOS 2.0 or later.

In Short: XEQ.COM saves you precious disk space by storing and running those little utilities and programs that clutter up your disk unnecessarily. Not copy protected.

CIRCLE 641 ON READER SERVICE CARD

FILE RECOVERY



Mace Utilities,

Version 4.0

Paul Mace Software

123 N. First St.

Ashland, OR 97520

(800) 523-0258

(503) 488-0224

List Price: \$99; upgrade from earlier versions, \$30 with original disk.
Requires: 256K RAM (32 Mbyte disk or larger requires 512K), two disk drives, DOS 2.0 or later.

In Short: An extremely flexible and powerful utility for restoring damaged disks and files. Can restore a formatted hard disk. Works on any DOS storage device. Not copy protected.

CIRCLE 642 ON READER SERVICE CARD



The Norton Utilities,

Version 3.1

Peter Norton

Computing, Inc.

2210 Wilshire Blvd.

Santa Monica, CA 90403

(213) 453-2361

List Price: \$99.95

Requires: 64K RAM, one disk drive, DOS 2.0 or later.

In Short: An indispensable set of utilities for restoring files, logging how long various system tasks take, reporting current status of a hard disk and more. Not copy protected.

CIRCLE 643 ON READER SERVICE CARD

FILE TRANSFER



Brooklyn Bridge

White Crane Systems

6889 Peachtree Ind.

Bldg.

Norcross, GA 30092

(404) 454-7911

List Price: \$129.95

Requires: Laptop computer, PC, XT, or AT serial port.

In Short: Cheaper than buying an add-on drive for a portable, the Brooklyn Bridge is an easy way to link laptops to desktops for file transfers from small disks to large disks and back. Not copy protected.

CIRCLE 644 ON READER SERVICE CARD



Software Bridge

Systems Compatibility

Corp.

One East Wacker Dr.,

#1320

Chicago, IL 60601

(312) 329-0700

List Price: \$149

Requires: 384K RAM, two disk drives, DOS 2.0 or later.

In Short: An inexpensive, reliable utility that will convert documents from nine word-processing programs to any in the group without losing underlining, boldface, and other special effects. Not copy protected.

CIRCLE 645 ON READER SERVICE CARD

HARD DISK UTILITIES



Disk Optimizer

SoftLogic Solutions Inc.

530 Chestnut St.

Manchester, NH 03101

(800) 272-9900

(603) 627-9900

List Price: \$59.95

Requires: 128K RAM,

one disk drive, DOS 2.0 or later.

In Short: A system for reorganizing a hard disk to speed performance. Also includes: a program that suggests when to reorganize clusters; a file security system; and a byte-level editor. Not copy protected.

CIRCLE 646 ON READER SERVICE CARD



Lightning

Personal Computer

Support Group Inc.

11035 Harry Hines Blvd.

Dallas, TX 75229

(214) 351-0564

List Price: Copy protected,

\$49.95; not copy protected,

\$89.95

Requires: 128K RAM, one disk drive.

In Short: A disk-caching RAM-resident utility that writes all your changed data to disk instantly—a slower but safer approach than that of many other disk-caching programs. Available with or without copy protection.

CIRCLE 647 ON READER SERVICE CARD



FACT FILE

KEYBOARD/SCREEN ENHANCERS



Fansi-Console
Hersey Micro Consulting, Inc.
P.O. Box 8276
Ann Arbor, MI 48107
(313) 994-3259
List Price: \$25 for software only; \$75 for software and user manual.

Requires: 32K RAM, one disk drive, DOS 2.0 or later.
In Short: A superb integrated console utility that replaces ANSI.SYS and includes numerous features to improve the responsiveness of your keyboard and monitor. Not copy protected.

CIRCLE 697 ON READER SERVICE CARD

KBFIX2, Version 3.0

Skip Gilbrech
90 Lexington Ave., #10-G
New York, NY 10016
List Price: Free, from BBSs and user groups.

Requires: DOS 2.0 or later.
In Short: A public domain wonder that will add refinement to cursor movement and speed. Not copy protected.

CIRCLE 698 ON READER SERVICE CARD

NoBlink/Accelerator,

Version 3.3
Nostradamus Inc.
3191 South Valley St., #252

Salt Lake City, UT 84109
(801) 487-9662
List Price: \$49.95
Requires: One disk drive, DOS 2.0 or later.
In Short: A welcome utility that spares you the annoying blink of the PC cursor. Not copy protected.

CIRCLE 699 ON READER SERVICE CARD



SuperKey
Borland International Inc.
4585 Scotts Valley Dr.
Scotts Valley, CA 95066
(800) 255-8008
(800) 742-1133 (in Calif.)

List Price: \$99.95
Requires: 128K RAM, one disk drive, DOS 2.0 or later.
In Short: A keyboard enhancer that essen-

tially appropriated pioneering ProKey's file structure, added a spiffy pull-down menu interface, and tossed in a mixed salad of everything from file encryption to an editable DOS command memory. Not copy protected.

CIRCLE 694 ON READER SERVICE CARD

PRINTER UTILITIES



Printworks for Lasers
SoftStyle Inc.
7192 Kalaniana'ole Hwy., #205
Honolulu, HI 96825
(808) 396-6368
List Price: \$69.95

Requires: 256K RAM, two disk drives, DOS 2.0 or later, laser printer.

In Short: A marvelous solution for dealing with the complexities of laser printers. Printworks lets you embed codes directly in a document, bypassing the need for your other programs to support laser printers. Not copy protected.

CIRCLE 693 ON READER SERVICE CARD



Sideways
Funk Software Inc.
222 Third St.
Cambridge, MA 02142
(617) 497-6339
List Price: \$69.95
Requires: 64K RAM, one disk drive, DOS 2.0 or later.

In Short: Simply the best sideways printing utility ever to come on the market. A must for I-2-3 users. Not copy protected.

CIRCLE 692 ON READER SERVICE CARD

RAM UTILITIES



PopDrop, Version 2.0
InfoStructures, Inc.
P.O. Box 32617
Tucson, AZ 85751
(602) 299-5962
List Price: \$19.95
Requires: 1.5K RAM, one disk drive, DOS 2.0 or later (3.0 recommended).

In Short: A handy RAM manager that helps you quickly and easily clear out unnecessary RAM-resident utilities when you need the memory for your application files. Not copy protected.

CIRCLE 691 ON READER SERVICE CARD

SECURITY

PC-Lock, Version 1.1

Johnson Computer Systems
20 Dinwiddie Pl.
Newport News, VA 23602
(804) 872-9583

List Price: \$17.50 registration fee; plus \$4 media charge for diskette (also includes PC-Lock, Version 1.2).

Requires: Under 2K RAM, hard disk, PC-DOS 2.0 or later; MS-DOS 2.0 or later (except MS-DOS 3.1).

In Short: PC-Lock is an ingenious security program that effectively protects your PC from prying eyes through locks on the keyboard, disk drives and peripherals. Not copy protected. (Version 2.0 is now available and will be shipped automatically to registered owners.)

CIRCLE 690 ON READER SERVICE CARD

SPREADSHEET UTILITIES



Spreadsheet Analyst
The Cambridge Software Collaborative
University Pl., #200
Cambridge, MA 02138
(617) 576-5744
List Price: \$89

Requires: 192K RAM, two disk drives, DOS 2.0 or later.

In Short: A fast and friendly I-2-3 utility that traces errors in a spreadsheet to their source. Not copy protected.

CIRCLE 689 ON READER SERVICE CARD

WORD-PROCESSING UTILITIES



StarFixer
Hard/Soft Inc.
Box 1277F
Riverside, NY 10471
(Also from Bantam)
(800) 222-9409
List Price: \$29.95 + \$2 postage

Requires: 256K RAM, DOS 2.0 or later, WordStar 3.24 or 3.3x.

In Short: A collection of powerful WordStar utilities that are what every utility should be: intuitive, useful and a great bargain. Not copy protected.

CIRCLE 688 ON READER SERVICE CARD

■ UTILITIES

Best of all, they can mostly restore, or "unformat," disks that you've erroneously formatted. *Mace Utilities* does this by putting a command in your AUTOEXEC.BAT file that copies the directory and FAT to a special file each time you boot. Since reformatting a hard disk leaves the data intact but wipes out both the directory and FATs, it can pretty much put things back the way they were at your most recent reboot. In fact, since DOS maintains its subdirectory structures in disk files, *Mace* can even reconstitute your subdirectories if you haven't used its program to squirrel away copies of the directory and FAT. Very useful.

However, *Mace* isn't exactly what you'd call friendly. It's handy that it highlights a section called "If you're in a hurry to get going," but this short chapter includes such thorny passages as "While you are changing AUTOEXEC, you might want to first COPY BACK-UP.M.U TO [sic] OLD.MU.DAT, then call RXBAK."

Face it, DOS needs all the help it can get. *Norton* and *Mace* are inexpensive DOS extensions that let power users work faster and smarter. Our collection of *PC Magazine's* Programming column utilities fill in many of the remaining gaps. If you're serious about performance, get them all. —Paul Somerson

The Norton Utilities 3.1

Unerase and system diagnostics are essential functions that no one should be without.

IBM and Microsoft should be horse-whipped annually at Comdex for releasing an operating system that's as cranky and full of holes as DOS.

They'll let you concoct complex subdirectory structures, but they don't give you a decent way to find files buried deep down some long-forgotten path—or specific text strings in those files.

They let you erase files with dispatch but don't provide any technique for bringing them back to life. (And, ironically, they'll let anyone with the right tool resurrect sensitive files you thought you had obliterated.) They let you monkey with the directory attribute byte—but don't provide

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- Calculators
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- Clipboard
- ASCII Table

Requires IBM PC/XT/AT or compatible, DOS 3.0 or higher, monochrome, CGA or EGA monitor. Uses 800 of 1MB Hard Disk recommended.

NOT Copy-Protected.

dBase III is a trademark of Ashton-Tate Corp.



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CIRCLE 204 ON READER SERVICE CARD

Personal VM on your PC!



Personal VM supports most of the VM/CMS functions found on the IBM mainframe computers. This power is now available on your IBM PC, XT, or AT and compatibles.

Personal VM features:

- CP and CMS commands
- CMS filetype support
- DOS compatibility
- LOGON security
- Minidisk support
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- Virtual spooling
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- VM-style screens
- User synonyms
- PF key definitions
- User profiles
- Privilege levels
- Log message support
- No additional hardware or software required

Personal VM runs most existing DOS applications without modification and eliminates cumbersome pathnames by automatically searching minidisks.

Interfaces with KEDIT and REXX from Mansfield Software Group.

Requires 256K IBM PC, XT, AT or compatible
Uses monochrome or CGA color display
Requires DOS 2.0 or above
Several users can be defined to access PVM with one session active at a time

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\$35 demo copy

(800) 247-4503 (Personal VM orders only)
(301) 564-8553 (inquiries & technical support)

CIRCLE 286 ON READER SERVICE CARD

■ UTILITIES

the tools to hide or unhide files or change anything other than the read-only and archive bits.

They don't give you any easy way to add up how many files are in each subdi-

rectory, or how much space these files take up. They don't provide a method for restoring a deleted directory, logging how long various system tasks take, or reporting the current status of your hardware.

Advertisement



REVIEWS IN BRIEF

Turbo-Cool: Keeping Your PC from Overboiling

BY JIM FORNEY

After years of slaving over hot circuitry, my faithful, overloaded IBM PC is running at least 15 degrees cooler these days thanks to an add-on cooling fan called Turbo-Cool from PC Cooling Systems. Turbo-Cool (formerly known as "Silencer, model HP") bolts onto the back of the PC over the power supply's exhaust grill, drawing up to 100 percent more air through the unit.

Prior to installing the Turbo-Cool, I measured a 30-degree temperature rise above ambient room temperature with a temperature probe positioned just above the motherboard and tucked in between two expansion boards. With Turbo-Cool installed and the temperature probe in the same location, the temperature rise was cut exactly in half—a mere 15 degrees hotter than my room—and the top of the PC's cabinet was significantly cooler to the touch at the hottest point (just above the location of the probe). Although "Silencer"—the name under which it was originally marketed—was a misnomer, Turbo-Cool's fan is much quieter than IBM's built-in cooling fan. In fact, there is no significant increase in the noise level with Turbo-Cool running.

Installation couldn't be easier, as it does not require going inside your computer at all. To install Turbo-Cool on a PC or XT, all you have to do is remove four screws from the back panel that secure the power supply in place. Then you simply attach the fan unit by inserting the longer screws supplied with it back into the same holes. The Turbo-Cool unit is just 3 inches thick and adds that much to the depth of a PC

when installed, but in terms of required clearance behind the CPU, it doesn't add much beyond what you would normally leave to prevent kinking all those connecting cables anyway.

The fan is supplied with a "Y" power cable, one end of which plugs into the monitor outlet on the back of the computer so that Turbo-Cool turns on automatically when you start your system. The other end of the Y has a monitor receptacle similar to the one that the fan has taken, so none of the original functionality is lost.

I've overheated my computer more than once, especially in hot weather. Heat can be a major problem and can cause all manner of strange things to happen, as well as shortening the lifespan of all those expensive plug-in boards and gizmos you've added to your system. This looks like it's about as slick a way to keep the bugs away on a hot night as any I've seen.



Turbo-Cool
PC Cooling Systems
Bonsall, CA 92003-0518
(619) 723-9513
Price: \$69.95 (PC or XT)
\$79.95 (AT)
Terms: VISA / MC / COD / PO's

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Worst of all, when IBM stuck a lemon hard disk in its original AT, it didn't provide even the simplest test for diagnosing errors on the fly.

For \$99.95, *The Norton Utilities* from Peter Norton Computing does all this and more. It's as simple as that. Okay, Norton's SysInfo is not wholly accurate in gauging performance. And his screen attribute program requires ANSI.SYS. Some of his menus are a tad cumbersome, and his vaunted Unerase program doesn't always restore your files without a hitch. (Norton's new Advanced Edition avoids many of these shortcomings and offers new features like an Unformatter, a disk optimizer, a directory commenter, and a program that allows better batch file interaction. His new basic 4.0 edition corrects earlier versions' deficiencies as well—and adds a handful of these new features. Both versions also include the Norton Integrator, a menu system that gives users moving-bar control over all the utilities on the disk and displays options and help information.) I can't imagine a serious system (or any hard disk system) that doesn't have a \NORTON subdirectory. So many people use my own hard disk when I'm away from the office that I practically put his Quick Unerase utility in my AUTOEXEC.BAT.

—Paul Somerson

PCED

Edit and customize DOS commands.

PCED, for Professional Command Editor, makes life at the DOS prompt more productive, more fun—and it costs only \$38. PCED, a 25K RAM-resident program from The Coke Software Group, allows you to edit the DOS command with the PC's arrow keys and the Insert key working the way that you'd expect, as in a word processor. PCED also will remember a stack of your previous DOS commands, which you can recall by using the Cursor Up and then edit. You even can "prestack" an incomplete command, use DIR to check a filename, and then call back the partially complete command.

The utility lets you define synonyms at the command line or from a configura-

■ UTILITIES

tion file it reads when it loads. You can use this file to do such simple tasks as making Alt-A represent "dir A:" (like a macro), or you can use it for more detailed tasks, such as replacing small batch files that incorporate several chained commands. Maintaining one file of synonyms is a lot easier than maintaining 100 batch files. In addition to batch file replaceable parameters like %1, synonyms you create with *PCED* have access to the time, date, and current path so that ending a synonym with "cd

■ **PC-LOCK** lets you hide the real password among incorrect characters.

&p" will change you back to the directory from which the synonym started.

PCED has numerous other functions that you'll find useful. The package comes with several optional modules, including a keystacking utility, and hooks to *SideKick* and *Personal REXX* (another batch-file-like language).

Products similar to *PCED* include its public domain predecessor, *CED*, as well as three commercial programs: *DOS Command Retriever*, from IBM's Personally Developed Software series; *Scroll & Recall*, from Opt-Tech Data Processing; and *TallScreen* from Qualitas.

If you're like me and use many different applications, spending much time at the DOS prompt, you'll find *PCED* an extremely valuable utility.

—Barry Simon

PC-LOCK

Block unauthorized access to your PC with this software lock.

PC-LOCK lets you go to lunch in peace. Johnson Computer Systems' security program (\$17.50) protects your PC from the curious, the playful, or the malicious with a software lock on its keyboard, disk drives and peripherals.

The program, which responds to a

password, appears as a device driver in the CONFIG.SYS file but is masked under an innocuous technical term that should camouflage it from unwanted eyes when the lock is not active.

PC-LOCK allows you to hide the real password among incorrect characters if someone is looking over your shoulder. It locks out snoopers who try to access the C: drive by booting from their own

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For Data Security
Sept. 1986

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PROTEC features Boot Protection (which stops people who try to boot from drive A getting into your hard disks), Access Control, User Segregation, Directory Locking, Optional Encryption, Software Anti-Theft Control, Direct DOS Control and Audit Trails.

In addition, **PROTEC** offers a sophisticated menu system, a file management system, a bulletin board and best of all, *PROTEC is incredibly easy to install!* Simply "overlay" it onto your current directory structure.

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So try **PROTEC** today and find out why PC Magazine named **PROTEC** "Editor's Choice".

Sophco Inc., P.O. Box 7430, Boulder, CO 80308

CIRCLE 218 ON READER SERVICE CARD

■ UTILITIES

■ **PC-12C** provides you with an on-screen adding-machine-style "tape" automatically printed or saved to disk—or both, if you wish.

diskette. (They get an error message). And it protects your system from uninvited keyboard input by blanking the screen so the machine appears off as it runs applications that require no keyboard input. Enter your password to restore the screen and keyboard action.

PC-LOCK can be found on most popular BBSs in an archive file that contains a user's guide, install/deinstall programs and utilities for changing passwords and hiding program files.

—Frank Derfler, Jr., and Ed Halbert

PC-12C

Exact emulation of Hewlett-Packard's HP12C calculator.

The \$99 **PC-12C**, from Popular Programs of Kirkland, Washington, is the best of the several PC financial calculator programs I've seen that emulate Hewlett-Packard's HP12C calculator. The HP calculator is the tool of choice for financial specialists—from bankers to corporate financiers to bond salesmen to real estate agents—for the universe of calculations that require more sophisticated number crunching than that performed

by the four-function wonders sold in blister-packs at K mart. The machine's legible display, crisp keypad, built-in financial functions, and compact but not too-small-for-fingers size have made it one of the few true business standards.

The **PC-12C**'s emulation of the HP12C calculator is exact. The program even gives you an on-screen adding-machine-style "tape" automatically printed or saved to disk—or both, if you wish. Besides the features of the HP12C machine, you get some features that only a PC program can offer. You can load **PC-12C** from your AUTOEXEC file as a RAM-resident pop-up, or call it as a standalone program. When you're using it as a pop-up program, one keystroke feeds the calculated results to your underlying program. And **PC-12C** thoughtfully kicks you into NumLock when you call it and returns to normal keypad functions when you exit.

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In addition to this specially-priced software plus PC Mouse combination, you get Designer Pop-up™ menus free. Designer Pop-ups let you create your own mouse-driven menus. So, the PC Mouse works with any software program written for use with a mouse. And quite a few which aren't.

The PC Mouse plugs right into your serial port. Or, the PC Mouse Bus Plus features a serial add-on board with two additional addresses, which gives you system expansion beyond COM1 and COM2.

Either way, you're getting the best mouse and the best software.

All, at the best price. Now.

CIRCLE 350 ON READER SERVICE CARD

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■ UTILITIES

PC-12C's popping up isn't perfect yet: it won't pop up over some graphics screens, and you may need to change the Alt-C keystroke combination used to call the program to avoid conflicts with Alt-key combinations that your applications programs may use. But *PC-12C* works fine used over 1-2-3, which is when I usually want a pop-up calculator. It's a super tool that makes a hard-disk-equipped portable PC even handier.

If you use Hewlett-Packard's HP12C, you'll find *PC-12C* very familiar. The HP12C uses "shifted" functions that are called by the preceding blue- or yellow-key keystrokes; Popular's *PC-12C* works the same way, using the Left and Right Shift keys for those functions and reminding you which is which by using the respective hue on a color monitor.

Other software vendors offer work-alike HP12C emulators, and the grapevine says Hewlett-Packard's about to

come out with its own. For now, though, Popular's *PC-12C* gets my vote.

—Jim Seymour

PopDrop

Remove resident programs from RAM with a few simple commands.

InfoStructures' *PopDrop* (\$19.95), itself a RAM-resident utility, offers a handy way to keep unnecessary or memory-eating RAM-resident programs out of your way. RAM-resident, or terminate-and-stay-resident (TSR) software, including some of the utilities highlighted in this issue, are wonderful—with just one touch of a key, you get instant access to a variety of helpful programs. But after you've loaded in your print spooler, RAM disk, DOS shell, spelling checker, calculator, and so forth, you may find that you no longer have enough room left for your

word processor or spreadsheet package.

PopDrop, an ingenious little utility, works like this: You insert a "layer" of *PopDrop* in between each of your RAM-resident utilities and then quickly whisk

■ InfoStructures'

PopDrop, itself a RAM-resident utility, offers a handy way to keep unnecessary or memory-eating RAM-resident programs out of your way.

Why you should buy a new program and a new PC Mouse. Now.

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The top selling integrated software program combining four applications used most frequently in your business—word processing, file management, spreadsheet analysis and electronic communications. It's integrated so you can switch quickly from one project to the next.



Drafix (\$299 Special Offer.
\$454 Suggested Retail for Program and PC Mouse.)

A high performance, full-featured, two dimensional CAD package. All of the drawing, designing and editing functions that designers demand from a serious CAD tool. Easy to use screen design and visual user interface.



Reflex from Borland (\$169 Special Offer.
\$308 Suggested Retail for Program and PC Mouse.)

A relational database with multiple windows giving you instant graphic analysis of your data with five views: form view, list view, graph view, crosstab view and report view. Easy to use. Allows you to view data from other programs like Lotus 1-2-3®, dBase® or PFS File®



DESQview (\$179 Special Offer.
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■ UTILITIES

away one or more of the programs if they begin to cause trouble. *PopDrop* works best when inserted into your AUTOEXEC.BAT file; you add POPDROP UP before each utility (or set of utilities) and simply type POPDROP DOWN to excise the top layer of programming from your computer's memory. POPDROP C clears out all your RAM-resident programs, except the bottom layer of *PopDrop*, and POPDROP S erases even that. The program's latest version also can give you a summary of all utilities currently in RAM and how much room they take up.

Two other RAM managers, TurboPower Software's *Mark/Release* (available on PC Magazine Interactive Reader Service) and Persoft's *Referee*, (\$69.95) are just as capable of doing the job. *Mark/Release*, a free public domain utility, performs the same services as *PopDrop* with the same minimum of fuss, using two programs instead of one. *Referee*, the most complex of the three utilities, has additional features, such as the ability to disable RAM-resident utilities without removing them from memory; *Referee* can't remove itself from memory, though.

When you're trying to take advantage of the wonders of RAM-resident programs but "Program too big to fit in memory" hits your screen, these three utilities—*PopDrop*, *Mark/Release*, and *Referee*—will come to the rescue.

—Barbara Krasnoff

Printworks for Lasers

Make short work of long escape codes with this laser printer utility.

SoftStyle's *Printworks for Lasers* (\$69.95), is a marvelous way to help you manage the many complex features of laser printers, which brings to mind the cliché that "with flexibility comes complexity." A program like *Printworks* almost is a necessity if you really want to take full advantage of the complex features laser printers have to offer.

The best-known laser printers, Hewlett-Packard's Laserjet and Laserjet 500 Plus, are almost legendary for their complexity. HP's Printer Control Language

■ Printworks for Lasers

lets you embed special codes in your documents to take advantage of your laser's fancy printing.

is chock-full of arcane escape codes and difficult control sequences. But you can leave the complex operations to *Printworks for Lasers*. Its capable device driver interfaces with the HP Laserjet (serial interface at 9,600 or 19,200 baud or parallel interface) or with Canon, Xerox, and other laser printers.

A separate *Printworks for Lasers* program, which can be RAM-resident if you wish, lets you control almost every aspect of your printer's operation. You can choose type fonts, download fonts (if your printer is able), set margins and page lengths, choose how many copies to print, and so forth.

What makes *Printworks* extraordinary though, is a slew of useful additional features. It gives you the high order characters you need for accurate screen dumps and emulates standard printers for software compatibility (the Epson MX-80, IBM Graphics, Diablo 630, and HP Laserjet). The utility's handy memo processor is useful for short memos and envelopes. Also, with *Printworks for Lasers*, you can embed special codes in your documents to take advantage of your laser's fancy printing features—even with software not designed for such print (including Lotus's 1-2-3)—and you even can capture and embed graphics images in your text output.

A single simple, elegant screen gives you access to all *Printworks for Lasers*'s features and commands, most of which are straightforward and easy to use. Many competing utilities for laser printers, such as *LaserControl* and *Printality*, are available, but *Printworks for Lasers* is the one I find so valuable that I use it every day. —Glenn Hart

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■ UTILITIES

SideKick

The original versatile desktop manager and aid.

Born in the infancy of the "desktop metaphor," Borland's International's *SideKick* (\$84.95 without copy protection) is a RAM-resident electronic version of four common desk accessories (calculator, calendar, notepad, and dialer) and an ASCII table. It's not fancy, but 10 minutes after you install it, you're hooked.

SideKick pioneers made it a bit even though early versions routinely crashed their machines. *SideKick* remains a slightly unsociable fussbudget. It demands to be loaded last, and gives packages like *QuickBasic* fits. But it's been taken into reasonable civility.

■ Many feature-laden competitors have come along, but *SideKick*'s look and feel are so elegant that few users have been seduced into switching.

The notepad lets you access directories anywhere and files as large as about 45K bytes. Since it's a full featured editor that uses *WordStar* commands (others, too, if you install them), the notepad is nothing less than a godsend to users of subdirectory-blind *WordStar*. *SideKick*'s screen-grabber and cut-and-paste facilities supply a quick Macintosh-like "clipboard" means of integrating disparate programs.

The few-frills calculator works in binary, hex, and good old decimal. The dialer picks phone numbers off the screen or searches for them (by name, company, or whatever) in a file, then uses your modem to call them. The ASCII table displays hex and decimal values and the corresponding screen character. The lame calendar lets you see a month's

dates at a glance but only half a day's appointments at once. Since its design makes it easy to lose data you thought you'd entered, you're likely to give up on it entirely.

SideKick encourages customization. A standalone installation program lets you change colors, trigger keys, and other defaults you're unlikely to fiddle with. The always-available setup window lets you customize default files and the size and position of the various windows.

Many feature-laden competitors have come along, but *SideKick*'s look and feel are so elegant that few users have been seduced into switching. Borland needs to proceed at full speed with *SideKick Plus* because Lotus *Metro* turns out to be serious competition—more than just an \$85 makeover of *Spotlight* (or the \$40 upgrade to *Metro*). In the battle between *SideKick Plus* and *Metro*, users are the likely winners.—Stephen Manes

Sideways

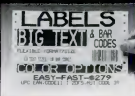
An easier way to print extra-wide spreadsheets.

If you use a spreadsheet program, Funk Software's clever *Sideways* (\$69.95) will become one of the handiest utilities in your toolkit. The problem? Most spreadsheets are horizontal rectangles; many are wider than can fit on one sheet of paper, even with 132-column printers set for 230 or so characters in eye-straining 16-characters-per-inch type. The solution? *Sideways*.

Without *Sideways* you have to let the spreadsheet program chop your work into zillions of vertical stripes for print-

■ *Sideways* will convert your worksheet from a character-based file to a graphics image and rotate it 90 degrees.

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■ UTILITIES

ing. Then you have to get down on the floor with a razor blade, adhesive tape, and those unwieldy printouts for an exciting game of I Hope I Get These Pieces Together in the Right Order.

With *Sideways* you just sit back and let it take over. It will convert your worksheet from a character-based file to a graphics image, rotate it 90 degrees clockwise, then print it out the long way down your fanfold paper on almost every popular dot matrix printer. If your spreadsheet is tall as well as wide, you may still have to assemble a strip or two, but you'll do far less paper shuffling, trimming, folding, and cursing than if you try printing it horizontally.

Sideways works with most of the popular spreadsheet programs; it even comes free of charge in the box with Computer Associates' *SuperCalc4*. Current versions (3.x) of the program, completely rewritten from earlier efforts, incorpo-

rate a slick, Lotus-like interface.

Other programs have appeared that perform the same function—including *Printer Boss* and *Sideprint*, a utility's utility that accompanies Consumers Software's *Spreadsheet Auditor*—but *Sideways* is still the best, with a superior interface, more choices of better-looking typefaces, and support for more printers. *Sideways* is such a fundamental improvement in spreadsheet printing that I find it hard to imagine using 1-2-3 without it.

—Jim Seymour

Smart Notes

Post-its for electronic files.

Smart Notes, from Personics Corp., adds graphic notes to your files without altering the contents of the target file. In this way, the \$79.95 *Smart Notes* does to computer files what 3M's sticky little

yellow Post-its do to paper documents.

The idea of attaching notes to spreadsheets or word processor files or even directories and subdirectories is simple in concept and (with *Smart Notes*) in application. But the way it works is pretty complex.

Basically, *Smart Notes* resides in the background. When you want to apply it to a file, you press a function-key combination and a graphics box appears at the cursor position. You type the desired information in the box and hit another key to end the transaction.

Although the note appears to be written in the target file, it is actually written in its own file and graphically overlaid on the target file.

In order to display these notes properly, *Smart Notes* (when active) continually scans the screen. When it sees a character or cell pattern it recognizes, it reads the associated note file to the screen.

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■ UTILITIES

■ **Smart Notes** does to computer files what 3M's sticky little Post-its do to paper documents.

Smart Notes is an ideal way to create annotated information not only for the individual user but among a group of users, each equipped with the package. *Smart Notes* is similar to Turner Hall Publishing's *Note-It* and costs the same, but *Note-It* is a 1-2-3-only program.

This is good idea that is beautifully implemented. It belongs in every serious computer user's library.

—Richard Arons

Software Bridge

Transfer files from one word processor to another and keep all the formatting intact.

Systems Compatibility Corp.'s *Software Bridge* converts documents from any of nine word processing programs to any other program in the group. Without *Software Bridge*, converting a document from one word processing program's file format to another's can be like getting root canal work: it's slow, tedious, painful, and you'll dread the next time.

Dropping down to a plain ASCII text file gets the words and paragraph breaks into shape to move from one word processing file to another, but you lose boldfacing, italic, underlining, tab depth, special tabs, headers, footers, footnotes, soft hyphens, and virtually everything else that attracted you to your new word processor in the first place.

We've seen lots of black-box hardware solutions to the problem, but all have been expensive. Moreover, this problem calls for a software solution, not another damn box.

Of several word-processor-to-word-processor conversion programs that have appeared, the best I've seen is *Software*

Bridge. This \$149 package will convert documents between any of the following nine word processing programs: *MultiMate*; *Microsoft Word*; *Wang PC Word Processing*; *WordPerfect*; *WordStar*; *DisplayWrite 2, 3, and 4* as RFT (reversible-form text) files; *SamnaWord II and III*; *Volkswriter 3*, and *WordMARC*. For \$49 more you can add DEC's dx document-exchange format to the list, to get into or out of DEC *WPS*. Other vendors charge three times as much for single-pair conversion programs.

Software Bridge works almost automatically. You can use global wildcard characters to specify conversion of more than one file at a time. Best of all, the utility gets everything out of the original word processing program's codes and into the new program's native codes.

Other programs are available for word processing conversion, including good products such as *Keyword Technologies' Softpak* and *Mastersoft's Word for Word*. But *Software Bridge* beats 'em all in value and ease of use.

Maybe someday everyone will use word processing software that can write to a true formatted-text-interchange format, such as IBM's beloved DCA. Until then, *Software Bridge* gets my vote for an inexpensive, reliable means of making the move from an old to a new word processing program a less traumatic experience. —Jim Seymour

Spreadsheet Analyst

Track spreadsheet errors to the last cell.

1-2-3 is a marvelously powerful tool, but its power can ruin you. A tiny error in a single 1-2-3 formula can turn a beautiful model into mush. But an \$89 1-2-3 utility, *Spreadsheet Analyst*, from Cambridge Software Collaborative, can save your spreadsheet and maybe your career, too.

Like other error-catching utilities, *Spreadsheet Analyst* finds formulas that refer to blanks or labels, numeric cells that aren't referenced in formulas, overlapping ranges, cells that display ERR or NA, ranges with more than one name, and other oddities. But logic errors are the most insidious, and the *Analyst* takes you right

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■ UTILITIES

into the guts of your model to help you find them.

If you're getting bum results in cell P58, read in your spreadsheet, go to P58, and start a Probe. *Analyst* displays the for-

mula in P58 and lets you follow every cell reference in it upstream right to its source. Many branches of logic affect P58, and you can check them all if you need to.

You can switch back into the spread-

■ A utility that keeps your spreadsheets honest, such as *Spreadsheet Analyst*, earns its keep every day.

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"FormWorx makes it easy to create forms. Inexpensive... easy to use." *The Wall Street Journal.*

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"This program simply does a beautiful job." PC Week. FormWorx has the features you need for crisp, effective forms. You can draw vertical and horizontal lines (single, double and bold) that print perfectly straight and solid. Use normal, wide, and large type sizes for titles and labels. And your forms can be any practical size, up to 11" x 14".

"The user interface is first rate." PC Magazine. Pull-down menus and clear commands make it easy to add a row, change a column, or move things around until every detail is just right. There's even an "undo" command for those times when your computer does what you say, instead of what you mean.

Lets you fill out forms perfectly. Fill out custom or even pre-printed forms on your PC without accidentally crossing a line, using text editing features like automatic

word wrap, on-screen underlining, bold-facing, and justification. Integrated macros let you automate repetitive tasks, type "boiler plate" phrases with a single key-stroke, jump from one blank to another, and more. And you can print the whole form or just the data on any of over 100 popular printers.

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FormWorx formerly Analyst International, Inc.
1365 Massachusetts Ave., Arlington, MA 02174

sheet to look at cells in context at any time. This feature of the *Analyst* is the most powerful tool I know of for tracking errors; by itself, it's worth the utility's price.

Once you've found a funky cell, the *Analyst* enables you to cross-reference other cells that refer to it, or even cells indirectly affected by it. You can see how everything—including your errors—ripples through to the bottom line.

Cambridge's *Spreadsheet Analyst* is fast, friendly, and easy to use. *HAL*, 1-2-3's \$150 natural language interface, is flashier. General Optimization's *What's Best!* (\$250 for the 250-cell program), a linear programming front end, is more mathematically elegant. But a utility that keeps your spreadsheets honest, such as *Spreadsheet Analyst*, earns its keep every day. —Jared Taylor

SQZ!

Maximize disk space by storing your spreadsheet files more compactly.

I don't know about you, but 1-2-3 is my primary operating environment and I am always running out of storage space. There are lots of options available to increase space: you can buy a larger capacity hard disk, or one of the easy-to-install hard cards, or even an RLL controller. But these alternatives are expensive and, frankly, I don't want to shoe-horn another piece of hardware into my well-worn PC chassis. The best solution I have found is *SQZ!*, a \$79.95 software utility from Turner Hall Publishing that reduces the size of spreadsheet files before saving them to disk.

SQZ! is a memory-resident program that is loaded before 1-2-3 or *Symphony* and will compact a file to about 20 per-

■ UTILITIES

cent of its original size. Although RAM-resident, *SQZ!* is completely compatible with *HAL*, and the manual lists 12 other memory-resident packages with which it is compatible, including *SideKick*, Version 1.56A.

This worksheet-compacting utility has a pop-up menu that allows you to select the format in which you want to save your files. For example, you may choose to save them with or without formula values; 1-2-3 normally stores the formula value along with the formula. Other

team of Mel Murch and Ward Starr (who are actually *PC Magazine*'s own Stephen Manes and Paul Somerson), is what every utility should be: intuitive, extremely useful, and a great bargain. For \$29.95,

you get two patch programs (*StarFixer* and *KeyFixer*), two utility programs (*FileFixer* and *RescueWS*), a number of batch files, and a 300-page manual (which includes an expanded edition of

■ *StarFixer*, a collection of *WordStar* patches and utilities, is what every utility should be: intuitive, extremely useful, and a great bargain.

menu choices include a password protection feature and a format for telecommunication file transfers. A new batch menu allows you to squeeze a group of previously created worksheets into the *SQZ!* format, making the transition to *SQZ!* painless.

The latest version of *SQZ!* will also work with *Spreadsheet Analyst*, *Reflex*, *Q&A* and *VP-Planner* worksheets.

Although there are a number of worthy commercial file-compacting utilities, including *Cubit*, from SoftLogic Solutions, and *Squish*, from Sundog Software, *SQZ!* is the best of those written specifically to reduce worksheet files.

—Christopher Barr

StarFixer

Management utilities and extra features for the classic versions of *WordStar*.

StarFixer, a collection of *WordStar* patches and utilities from the Hard/Soft



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■ UTILITIES

another classic, *Underground WordStar*).

It's for *WordStar*, Versions 3.24 to 3.31—every North American *WordStar* released in the last 5 years except *WordStar* 4.0. *StarFixer* should appeal to users

who want more clout from their current *WordStar* and who aren't planning to upgrade. (*WordStar* 4.0 uses different patch points that *StarFixer* won't recognize.)

Because the *StarFixer* programs use a

WordStar-like interface, there is no learning curve. Changing the printer installation, for example, is as intuitive as entering the print menu, selecting the printer type, toggling the appropriate port, and saving the patched WS.COM as you would a document, by hitting KD. The entire process takes well under a minute. Other programs may patch *WordStar*, but none of them (especially not MicroPro's own *Winstall*) are as easily accessible to novices and power-users alike. Accomplishing the above task with *Winstall* involves answering 5 billion prompts and then fumbling through umpteen menus before entering any data.

■ *StarFixer* and *KeyFixer* provide important features MicroPro either neglected to supply or claimed were impossible to provide.

If you are finished before your patience is, you probably wrote the program.

StarFixer and *KeyFixer* not only make *Winstall* superfluous, they also provide features MicroPro either neglected to supply or claimed were impossible to provide. *StarFixer*, for example, enables you to avoid the opening screen, race through messages such as "New File", and prevent accidental deletions. *KeyFixer* allows you to reassign your function and cursor pad keys, install either ten new function keys, and change the text and color of such things as the status line. Best of all, you never enter any hex codes.

The package converts documents from *WordStar* to ASCII format and vice versa, removes or keeps control codes and dot commands, counts words, and checks for unpaired control codes. This last feature saves you from unknowingly underlining or boldfacing a complete document. If you have ever mistakenly abandoned a document, you will love

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CIRCLE 532 ON READER SERVICE CARD

■ UTILITIES

RescueWS, a utility that retrieves the document from thin air (actually, RAM). The newly rescued file may need some doctoring, but so would you after a trip to limbo.

As if the above were not enough, the package also includes batch files for patching WordStar to display 43 lines on an EGA monitor, reformatting mail-merge files, and using WordStar with a RAMdisk. For the curious, the manual explains the inner workings of WordStar and supplies enough hints and source code for you to make your own patches.

StarFixer is my choice for the best WordStar utility package because of its interface, capabilities, and price. It even shows how to get WordStar to follow a path, and makes it faster and more powerful.—**Vincent Puglia**

SuperKey

Teach your keyboard to be almost as smart as you are.

Keyboard enhancers like the one I prefer, Borland International's *SuperKey* (\$99.95), became essential PC utilities when Borland introduced David Rose's pioneering *ProKey*. The power to invoke a "record" mode that could "teach" your next eleven-seven keystrokes to be one single key evoked high hosannas. The power to reconfigure the keyboard for different situations and store each setup in a separate file brought further praise and cries of ecstasy.

■ *SuperKey* allows you to handle time and date functions, screen blanking, macro file swapping, and stealing text from the screen to assign it to a key.

Since then, keyboard enhancers have managed to add all sorts of goodies, including actual bells and whistles. Each program has its strengths and limitations. *SuperKey* essentially appropriated Pro-

Key's file structure, added a spiffy pull-down menu interface, and tossed in a mixed salad of everything from file encryption to an editable DOS command memory.



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■ UTILITIES

Redefining the entire keyboard must be done from DOS. But from within any program, *SuperKey* lets you handle virtually everything else, including time and date functions, screen blanking, macro

file swapping, and stealing text from the screen to assign it to a key.

SuperKey's main competitors are Alpha Software Corp.'s *KeyWorks*, which allows users to create customized mov-

ing-bar menus; Software Research Technology's *SmartKey II Plus*, whose ace in the hole is the ability to create macros from keystrokes you've already executed and suddenly realized you'd like to play back with a single keypress; a bunch of public domain programs; and Lotus's new *Metro*.—Stephen Manes

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TallScreen

On-screen power to remember, stack, and reissue DOS commands.

Using a PC without Qualitas's *TallScreen* (\$49.95) is, to me, an object lesson in how limited DOS really is. Here are a few of the many things this RAM-resident DOS utility does: It captures DOS's output in a large buffer, so you don't lose the text that scrolls off the screen. It stores the DOS commands you issue and your change directory commands. And its pop-up windows let you reissue commands or move around your hard disk quickly and painlessly.

Also, *TallScreen's* editing commands enable you to edit any text on the screen or in the buffers. This feature is so handy that I never need to use an editor or word processor to create or modify batch files or other short text files.

TallScreen does even more. It lets you issue multiple DOS commands on a single line. You also can mark a block of text on the screen and then print it, save it to a disk file, or otherwise manipulate it. *TallScreen* assigns user-defined sequences to keys, much as a keyboard utility does, and it offers all the functions the ANSI.SYS screen driver normally performs. *TallScreen* gives you pop-up

■ *TallScreen's* pop-up windows let you reissue commands or move around your hard disk quickly and painlessly.

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But what is Metro? And what will it do for you?

According to PC Magazine, it's an unprotected, "all-things-are-possible terminate-and-stay-resident (TSR) program that can potentially replace most, if not all, of the TSRs you customarily use."

A powerful macro function and 12 ambitious accessories.

Quite a mouthful. But, then again, quite a product. Metro combines a powerful macro processor with 12 other accessories. Of the macro function, Info World writes, "... (it) goes further than similar products and provides the elements of a simple programming language." "In a word," continues PC Magazine, "excellent."

Of the 12 other accessories, Info World noted "... we expected a few of them to be of limited usefulness or poorly implemented. We did not find this to be true."

These accessories include:

- The filer, which organizes data and program files, and performs DOS functions.
- The editor, which allows you to write memos, letters, and reports without leaving Lotus 1-2-3® or Symphony®.
- The phone book, which dials your phone and produces mailing labels.
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- The list manager, which maintains to-do lists, and tracks tasks and projects.
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- The notepad, which records ideas, memoranda, and notes.
- The appointment book, with audible alarm, which maintains daily, weekly and monthly calendars.
- The kaleidoscope, which customizes the accessory display for color monitors.
- The configuration, which manages the memory allocation of Metro and customizes its functionality.
- And the special characters, which serve as a reference for ASCII characters.



A real solution to RAM-Cram.

What makes Metro more functional than any comparable product is that all 12 of its accessories need not be in memory at the same time. Once the Metro kernel is loaded, you may call up any or all of the 12 accessories, customizing your own program. In the words of P.C. Letter, "Metro offers a comprehensive, essentially bullet-proof, single vendor alternative" to using other, incompatible accessories. And you can unload it from memory with a single keystroke.

"What's most attractive about Metro," continues P.C. Letter, "is that you don't have to worry about its accessories killing each other or the application" you're using. Metro essentially provides "that long awaited, much debated solution to what's fondly known as RAM-Cram."

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Amid all this praise, there must be a problem, you think. Perhaps it's difficult to use? Not so, says Info World. "We had Metro up and running 20 minutes after tearing off the shrink wrap."

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Lotus Metro

The memory-resident desktop manager combining twelve accessories and a powerful macros program.

System Requirements: Lotus Metro runs on IBM® PC/XT/Portable PC, Portable AT™, COMPAQ PORTABLE™, COMPAQ PLUS™, COMPAQ DESKPRO™, Two 5 1/4" double-sided disk drives (hard disk recommended for optimal performance). Maintenance of RAM required for RAM residents: kernel of Metro, DOS 2.0 or higher. Metro is copyrighted and can be removed from memory.
Lotus Metro runs with a wide variety of software programs, including 1-2-3®/Symphony®/Symphony: Spelling Checker/Symphony: Test Outliner, 1-2-3 Report Writer™ and Signal™.
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■ UTILITIES

help for using both it and DOS, and lets you store your personal preferences, frequently used subdirectories, and other startup data.

TallScreen remains resident in RAM

once invoked and consumes about 64K of memory, depending on your specifications for buffer sizes. It's very forgiving about working with other terminate-and-stay-resident (TSR) programs.

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■ You can take all those little utilities that clutter up your disk, shovel them into *XEQ*'s beckoning maw, and clear away the space-wasting originals.

Other programs offer some of *TallScreen*'s features (Opt-Tech's *Scroll & Recall* and The Coke Software Group's *PCED*, which is reviewed in this article, for example), but I haven't seen anything as powerful, yet as simple to use as *TallScreen*.—Glenn Hart

XEQ.COM

Squeeze programs into smaller spaces on your hard disk.

XEQ.COM from Hardwood Software Associates, is a voracious little monster of a program that greedily swallows programs for lunch and burps loudly on command. Actually, it's more benevolent than it sounds. It can save you thousands of bytes of valuable disk space.

XEQ by itself does nothing. You store other programs within it and run them from there. A group of programs stored in *XEQ* (available free from any bulletin board or disk library) can occupy a whole lot less space than the same programs stored as separate files.

Even a little 20-byte program takes up 1K on a floppy disk, 2K on a 20-megabyte hard disk, and 8K on a 10-megabyte disk. But when you insert a dozen 10-byte programs into *XEQ*, each adds only 20 bytes (plus 14 for housekeeping) to the 3K of *XEQ* itself. You can take all those little utilities that presently clutter up your disk, shovel them into *XEQ*'s beckoning maw, and clear away the space-wasting originals.

To run a program like Charles Petzold's DDIR from inside *XEQ* you enter

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■ UTILITIES

XEQ DDIR. But you can simplify this by using *PCED* (see our review by Barry Simon) to make DDIR a "synonym" for XEQ DDIR. *XEQ* accepts only .COM files and grows only to 64K. But you can

use more than one *XEQ* by giving each copy a different name.

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XRAY.COM

DEBUG memory using a real-time window.

DOS's DEBUG program is just great for snooping around in memory and finding out exactly how programs work (and why they sometimes don't). But when debuggers aren't enough, I turn to *XRAY.COM* (\$20), a memory-resident pop-up utility written by John F. Ferguson that provides a real-time window of any selected memory area in the 1-megabyte address range of the PC.

XRAY loads at the command line and pops up with the Alt-Left Shift key combination. The program's main menu offers the various options that activate *XRAY*, change the window size and location in memory, scroll through RAM, unhook *XRAY*, and indicate the currently executing memory address.

A screen-sharing algorithm lets *XRAY* display up to 128 bytes of memory (shown in hex and ASCII) while programs that use BIOS video routines operate in the lower half of the display. Using *XRAY*, it is possible to watch the contents of flags, switches, or buffers change inside programs as they run. Even memory-resident programs can be examined while other applications run.

■ Using *XRAY*, it is possible to watch the contents of flags, switches, or buffers change inside programs as they run.

There was no documentation with the copy of *XRAY* I downloaded, but popping it up is all that is required to master it. The only complaint I have about *XRAY* is that the menu selections sometimes use the same keys for different tasks.

—Robert L. Hummel

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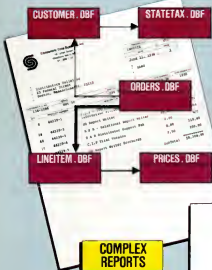
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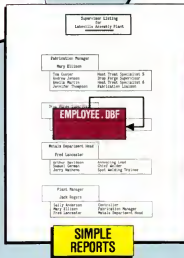
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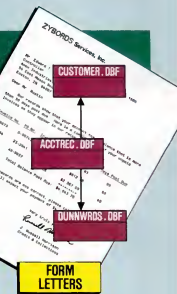


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■ PC LAB NOTES: SETTING EGA COLOR ■ ROBERT L. HUMMEL

GET THE FULL EGA COLOR SPECTRUM

You can produce a custom color palette for existing software programs that run under the EGA as easily as you can enter SPECTRUM.

If you don't have an Enhanced Graphics Adapter (EGA), chances are you will soon. If you have an EGA, however, chances are you still boot up in gray on black. If you do, chances are you will soon add SPECTRUM to your system. [SPECTRUM also works on IBM's newly announced Personal System/2 computer line, described in PC Magazine, First Looks, page 38, Volume 6 Number 10.—Ed.]

In the 2 years since IBM introduced the EGA and its companion Enhanced Color Display (ECD), the EGA standard has spawned any number of compatible adapters and monitors from various manufacturers. Despite its unquestioned popularity, however, if you've shelled out the money for EGA equipment in the expectation of better resolution, more display colors, and eye-popping graphics, you know only too well that so far what you've bought are mostly promises. Applications software producers have been slow to exploit the capabilities of the EGA (PC-DOS is one of the worst offenders), and until existing software applications are rewritten, the special features of the EGA will continue to go largely unexploited.

In the meantime, however, SPECTRUM will at least allow existing software to use the EGA's extended color palette. An easy-to-use, memory-resident utility that works with your current software, SPECTRUM allows you to designate any 16 colors from a palette of 64 as your default colors. Applications that currently use color as well as those that were born color-blind can be made "EGA-aware" without modifications or patches.

With SPECTRUM, at the touch of a "hot key" you can change the current screen colors from within your spreadsheet, word processor, or database program. The colors on the monitor change right before your eyes as you make your adjustments, so you can instantly see how the final program display will appear. And in addition to its pop-up mode, SPECTRUM allows complete custom color palettes to be loaded from the command line or in batch files, providing the opportunity to change screen colors at any time.

PRODUCTIVITY INDEX

PC LAB NOTES

SPECTRUM gives your programs the color of the full EGA palette.

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Programming the 8087 chip and an expert guide to its number formats.

GETTING SPECTRUM The easiest way to get your own copy of SPECTRUM is to download it by modem from the PC Magazine Interactive Reader Service, as explained in the accompanying sidebar. You may, however, wish to type the listing in yourself. The assembly language listing is shown in Figure 1, and a BASIC program that will create SPECTRUM.COM when you run it once is shown in Figure 2.

USING SPECTRUM The EGA is at its best when connected to an Enhanced Color Display. On monitors such as the IBM ECD or the NEC MultiSync, the EGA can display up to 16 different colors from a palette of 64. When connected to an old-style color display, your palette choices are hardware-limited to the original 16 colors of the CGA. And, when connected to a monochrome monitor, you can choose between black, white, and bright. The relation between the EGA and its predecessors is explained in the sidebar "Display Adapter Evolution." I'll assume here that you're using a monitor that can take full advantage of the EGA.

Once you have obtained SPECTRUM.COM, you can install the program either by entering SPECTRUM at the DOS prompt or by putting the command in your AUTOEXEC.BAT file. SPECTRUM will make itself memory resident and return control to DOS. From that point on, simply hold down the Ctrl key and press the Grave Accent (`) key (also sometimes called the Reverse-Apostrophe key) to pop up the dialogue window.

■ PC LAB NOTES

DOWNLOADING SPECTRUM

The programs that appear in our Programming/Utilities column (as well as other programs we publish) can be downloaded by modem from the PC Magazine Interactive Reader Service. There is no charge for this service, but users are cautioned that these programs are copyright material and are made available only for individual, noncommercial use. You may make copies for others (including placement on noncommercial electronic bulletin boards), as long as no charge is involved. However,

making copies for any commercial purpose is strictly prohibited.

The modem number for PC-IRS is (212) 696-0360. Set your modem and communications software to use 1,200 (or 300) bps, 8 data bits, 1 stop bit, no parity. PC-IRS files with a .COM, .EXE, or .ARC extension require that you also use the Xmodem error-checking protocol; our other files (e.g., with extensions of .ASM or .BAS) can be downloaded using either regular ASCII or Xmodem transmission.

SPECTRUM.BAS, whether typed in from the magazine or downloaded from the PC-IRS, will automatically create SPECTRUM.COM when run once in BASIC. SPECTRUM.ASM, also listed both here and on the PC-IRS, allows you to modify the program but requires you to use a macro assembler (IBM or Microsoft, Version 2.0 or later) and the following commands:

```
MASM SPECTRUM;
LINK SPECTRUM;
EXE2BIN SPECTRUM SPECTRUM.COM
```

SPECTRUM AT A GLANCE

Syntax:

```
[d]:[path]SPECTRUM
```

Operation: SPECTRUM is a memory-resident utility designed to provide existing software with a 16-color (of 64) customizable palette when used with an Enhanced Graphics Adapter and an Enhanced Graphics (or similar) Display monitor. When loaded (usually via an AUTOEXEC.BAT file), pressing the Ctrl-<Grave Accent> key combination pops up a display window contain-

ing the current colors mapped to the 16 EGA registers. Using the cursor keypad keys (plus Esc), each of the 16 registers may be assigned any one of 64 colors. Changes may be saved or aborted, or the default colors selected.

Syntax: For loading or changing the SPECTRUM palette without going through the pop-up window (as part of a batch file, for example), the required syntax is as follows:

```
SPECTRUM xx xx xx xx xx xx xx xx xx xx
xx xx xx xx
```

Each *x* is a digit from 0 through 7. A single space must separate each of the 16 pairs of digits, and a single space must also separate the number pairs from the command name.

SPECTRUM is compatible with most TSR programs (including *SideKick*). Programs that write directly to the registers override the SPECTRUM selections. The SPECTRUM colors may be restored, if lost, by popping up the display window (Ctrl-<Grave Accent>) and then pressing the Esc key.

The dialogue window itself contains a help line that explains your options. Except for the Esc key, which is variously located on different keyboards, all of the keys that are used to control SPECTRUM are located on the numeric cursor pad. The Left and Right Arrow keys move the pointer to select which color you'll be changing. The Up and Down Arrow keys control the mixture of primary red, green, and blue (RGB) in the active color box. The PgUp and PgDn keys perform the same function with the secondary red, green, and blue (rgb). Pressing the Home key from inside SPECTRUM resets all the colors to their default EGA settings. The End key saves your currently displayed colors and returns you to your application with them. And, finally, the Esc key exits SPECTRUM and undoes any experimental changes you

have made and subsequently regretted.

When inside the pop-up window, the row of numbers 00 through 15 directly below the color boxes use the same numbers used by the BASIC COLOR statement. DOS normally displays text in color number 7 (white) on background color 0 (black). To change these colors, change the color box above the 0 and the 7 on the SPECTRUM display.

The numbers appearing above the color boxes uniquely identify the color in the boxes below them. Each digit in the number represents three color signals encoded as a binary number. The left digit represents the primary RGB color signals and the right digit represents the secondary color signals. So, the color RED, with no GREEN or BLUE, would be shown as the digit RGB = 100b = 4. Magenta, a com-

bination of RED and BLUE, would be 101b = 5. Each digit has a range from 0 to 7. These numbers are provided as a convenient way to help you identify colors as you develop them. Since you can see the colors on the screen, you don't need to memorize which number produces a particular color. Once you have determined a color palette that suits you, use the numbers as a guide to help set them quickly. To change the colors, simply pop SPECTRUM up and make any adjustments necessary.

If you design a complex palette where many colors are remapped, or you want to use different colors with your word processor than with your spreadsheet, you might find that changing colors manually is a nuisance. Fortunately, there's a better way. SPECTRUM lets you specify the values

[illegible]

continuous

Figure 1: *The source code for SPECTRUM.COM.*

BC MAGAZINE

```

RTN  AG,WHN      :File TTY
INT  100         : Then BDD
FEY                     :Double Stry

```

[illegible]

```

=====
; Fill in the window information on screen. String format is col,row,text,0.
; DO-BIT points to string.
MR_MESSAGE      PROC      NEAR
MOV             RDI,DIFFSAT_PMR
; This line
; sets intended position
MOV             DX,AX
MOV             AX,2
; Position cursor

%END_LOOP;
INT             19H
MOV             AX,EBX
; The BIOS
; writes AX to TTY
; if E, end of string
; else, repeat
MOV             AX,AL
JNZ             $,NO_LOOP
SET

MR_MESSAGE      ENDP
=====
; Video int 19H interrupt. If mode is changed, reset color.
; A font lead changes mode internally and causes a reload.
INT_19          PROC      FAR
; Video mode change
; handle specially
; OC possible font lead
; (internal mode change)
; assume old video interrupt
MOV             PTR CH:OLD_INT_19
; allow interrupts
; simulate original interrupt
; and return here
PUSH            CS
INSTR           CH:OLD_INT_19
; Save used registers
PUSH            AX
; Set current video mode
; The BIOS
; set color text mode
; or mon text mode
; or mon text mode
; set the palette rage
; read of registers to set
; of registers to set
; read of registers
; set palette registers
; Palette # in BL
; Attributes in BH
; video pointer
; The BIOS
; Restore registers
; Par return, pop flags
; to simulate INT
INT_19          ENDP
; DOB int 19H interrupt. Set flag while using memory to save space
; The purpose of this procedure is to keep pop-up from taking control
; of the machine when doing so would cause a crash.
; Function 0 changed to 4Ch to avoid DOS problem with CH register.)
INT_21          PROC      FAR
MOV             CH:OLD_FK_FLAG,0
; Assume not function 1-Ch
; If program is using DOS 1-Ch
; JNE         CHECK
MOV             AX,4Ch
; Change it to 4Ch
GO_DISPLAY;     JMP         OVER_PPW CH:OLD_INT_21
; Jump to original routine
CHECK;          CMP         AX,0
; DOS function call under 40
JAE             GO_DISPLAY
; low function
; Simulate interrupt
; with FAK CALL
INSTR           CH:OLD_FK_FLAG
; Turn off flag
; Restore int flag source and
; released old flag
INT_21          ENDP
=====
; Note here is allocated after the program loads into memory to save space
; in the DOS file to the basic listing will be smaller.
; PC variable used to keep track of relative address.
PC              = 0
; set imaginary counter
SCREEN_BUF      = PC
; DOB SHOWPROC(2) (MIP)
PC              = PC + SCREEN * SCREEN * 2
; DOB 14 (MIP)
HBM_COLORS      = PC + 16
; PC
LAST_STR        = PC
=====

```

(Figure 1 continues)

■ PC LAB NOTES

```

; Book the necessary interrupts to avoid a collision.
; Terminate and Stay Resident (TSR).
INITIALISE PROC NEAR
    ANOSAVE CH:CSIO, DS:CSIO, DS:MOVESIO, DS:CSIO
    MOV    DI, OFFSET COVERIGHT
    MOV    AH, 9
    INT    21h
; If command line parameters are present, load them into the registers
    JB     NO_ARGS
    MOV    SI, 42h
    MOV    DI, OFFSET OLD_COLORS
    MOV    CX, 16
    ; First parameter
    ; Destination
    ; Get digits
    ; ASCII to hex
    AND    AX, 8CF0h
    RCL    AX, 1
    RCL    AX, 1
    RCL    AX, 1
    ; Combine in AX
    ; Put in OLD_COLORS
    ; Only past delimiter
    ; Palette value is 80
    ; Get palette fn
    ; Get palette number
    ; In SI
    ; Thru 800
    INC    SI
    MOV    SI, 800
    MOV    AX, 1800h
    MOV    SI, 16
    MOV    SI, CL
    REP    STB
    INT    21h
    JMP    PALETTE_LOOP
NO_ARGS:
    ; Check if already loaded in memory. Don't load multiple copies.
    MOV    WORD PTR [BPTPC+6], 0
    MOV    WORD PTR [BPTPC+2], 0
    ; Modify to avoid false check
NEXT_PARAM:
    XOR    BX, BX
    MOV    AX, CX
    INC    BX
    MOV    AX, 80
    MOV    SI, 80
    JB     END_SEARCH
    MOV    DI, 0
    MOV    DI, 81
    ; Compare first 16 bytes
    ; CPU didn't find it
    ; All matched?
    ; If not, compare
    ; Offset to name
    ; Compare first 16 bytes
    ; CPU didn't find it
    ; All matched?
    ; If not, compare
    ; Offset to name
    ; Found a copy in memory
    ; If no previous
    ; Go matching
    ; Load colors into memory
    MOV    DI, 81
    MOV    SI, 80
    REP    MOVSD
    ; From DS:SI to ES:DI
    MOV    DI, 81
    MOV    SI, 80
    REP    MOVSD
    ; Terminate with 'error'
    ; Thru DOS
    ; Save vector 9 in AX
    ; Get address function
    ; Thru DOS
    ; Save address in 16:01
    ; Get AX back
    ; Set new address to DS:01
    ; Thru DOS
    ; Set a pointer to the DOS Critical Flag, a one-byte location in low memory
    ; that is set when DOS is in an un-interruptible state. Location is returned
    ; in ES:BX. This is undocumented, but works in DOS 3.0 - 3.21
    MOV    AX, 30h
    INT    0Ah
    MOV    WORD PTR DS:[0x10], 0
    MOV    WORD PTR DS:[0x12], 0
    ; Book the keyboard interrupt for the hot-key detection routine.
    ; Book DOS interrupt 21h to set busy flag.
    PUSH    DS
    POP     DS
    MOV    AL, 9
    MOV    DI, OFFSET OLD_INT_9
    MOV    DI, OFFSET INT_9
    CALL    SET_INT
    MOV    AL, 10h
    MOV    DI, OFFSET OLD_INT_10
    MOV    DI, OFFSET INT_10
    CALL    SET_INT
    MOV    AL, 11h
    MOV    DI, OFFSET OLD_INT_11
    MOV    DI, OFFSET INT_11
    CALL    SET_INT
    ; Deallocate the copy of the environment loaded with the program.
    MOV    AX, WORD PTR DS:[0x10]
    MOV    SI, 0
    MOV    DI, 0
    INT    21h
    MOV    DS, OFFSET LAST_BYTE - OFFSET CSIO + 15
    MOV    AX, 3100h
    INT    21h
INITIALISE ENDP
; *****
; Get/Set/Set the interrupt vector. AX contains vector number.
; 0x01 points to DOS0 destination for old address.
; 0x00 points to new interrupt address. AX destroyed.
; *****
SET_INT PROC NEAR
    ANOSAVE CH:CSIO, DS:CSIO, DS:MOVESIO, DS:CSIO
    PUSH    AX
    MOV    AX, 35h
    MOV    SI, 0
    MOV    WORD PTR [0x10], 0
    MOV    WORD PTR [0x12], 0
    POP     AX
    MOV    AX, 25h
    INT    21h
    RET
SET_INT ENDP
CSIO ENDS
END

```

(Figure 1 ends)

for the 16 colors on the command line when you load it.

Assume you want to set DOS to use your custom colors when you boot up. First, use SPECTRUM in the pop-up mode to design the palette. Then copy the 16 numbers as they appear over the color bars. In your AUTOEXEC.BAT batch file, include a line that has the program name SPECTRUM, a single space, and then the 16 two-digit numbers (you must include leading zeros) you copied from the dialogue window. For example, I use the following line in my AUTOEXEC.BAT file.

```
SPECTRUM 01 00 20 10 40 50 60 66 87 17 27 37 47 57 67 78
```

If you enter less than 16 numbers on the command line, SPECTRUM will terminate without changing the current palette. Extra characters after the 16 numbers are

ignored. SPECTRUM is pretty inflexible on the format, so entering characters other than the digits 0 through 7 or not using a single separating space can produce some

■ SPECTRUM is a well-behaved resident program and should be compatible with other TSR programs.

strange looking displays. If this happens, press Ctrl-<Grave Accent> and Home to restore the default colors.

SPECTRUM is a well-behaved resident program and should be compatible with other TSR programs and applica-

tions. If you experience problems when loading SPECTRUM, try changing the order of loading or eliminating utilities until you find the conflict. SideKick users should be sure to load SPECTRUM before loading SideKick.

If a copy of SPECTRUM is already memory resident, executing it from a batch file or the command line loads the colors into the resident copy and then terminates. So you can run SPECTRUM as many times as you like without using additional memory. By creating batch files to start your applications, you can include a call to SPECTRUM to provide a custom palette for each.

FADE TO BLACK One such special-purpose batch file allows SPECTRUM to do double duty as a screen blanker. Simply create a batch file named BLACK.BAT containing the program name SPEC-

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■ PC LAB NOTES

DISPLAY ADAPTER EVOLUTION

Two display adapters were introduced with the PC: the Monochrome Display Adapter (MDA) and the Color Graphics Adapter (CGA). The MDA was intended for business applications. It was capable of displaying only text and designed to be used with a high-resolution, monochrome display. The CGA met the needs of home and game use. It was designed to operate with home television sets, composite, and direct-drive monitors. In addition to providing 16 color or text modes, the CGA supported two graphics modes.

Both adapters were designed around the Motorola 6845 Cathode Ray Tube Controller (CRTC). The 6845 is a programmable device with 19 accessible registers that are used to define and control the display. The 6845 registers are special memory areas that can be written to or read from using I/O ports. A list of the 6845 register descriptions is provided in Table A.

The registers are accessed by indexing. Indexing is a method of providing more programming access to a device by

Table B: Register Descriptions for the EGA CRT Controller

| Register index | Register usage |
|----------------|---------------------------|
| 0 | Horizontal total |
| 1 | Horizontal display end |
| 2 | Start horizontal blank* |
| 3 | End horizontal blank* |
| 4 | Start horizontal retrace* |
| 5 | End horizontal retrace* |
| 6 | Vertical total* |
| 7 | Overflow* |
| 8 | Preset row scan* |
| 9 | Maximum scan line |
| A | Cursor start |
| B | Cursor end |
| C | Start address high |
| D | Start address low |
| E | Cursor location high |
| F | Cursor location low |
| 10 | Vertical retrace start |
| 11 | Light pen high |
| 12 | Vertical retrace end |
| 13 | Light pen low |
| 14 | Vertical display end |
| 15 | Offset |
| 16 | Underline location |
| 17 | Start vertical blank |
| 18 | End vertical blank |
| 19 | Mode control |
| 1A | Line compare |

*The register does not map directly to the 6845 CRTC controller.

letting one I/O port do the work of many. I like to think of it as a telephone switchboard. First, you tell the "operator" the number of the register you wish to program by writing to the "address register." The "operator" then forwards the next value written to the "data register" to the correct internal register. All the logic for this is contained within the device. Indexed registers are used extensively in display adapters to conserve I/O space and simplify design. (It's important to note that the address and data registers can reside at the same I/O port address, but are not required to do so.)

Before either the CGA or MDA display adapter can be used, the 6845 must be programmed to generate the correct scan parameters for the connected display. Each register must be addressed and loaded with the proper value. Fortunately, this task—as well as most direct programming of the 6845—is accomplished by the routines encoded in the system board BIOS. Some applications, however, program the 6845 directly, either to increase performance or to use capabilities the BIOS does not support.

The EGA does not use the Motorola 6845 as its CRTC device. Instead, a custom LSI (Large Scale Integration) device is used. This chip is similar to the 6845 in function but contains some important differences. Table B gives a description of the EGA CRTC registers. While many of the functions of the 6845 registers are represented, some are missing or assigned different register numbers. This means that the EGA is not compatible with the CGA or MDA at the hardware level. Applications that program the 6845 chip directly can run into serious problems with the EGA.

The EGA BIOS is written so that applications that use the BIOS interface and do not directly program the 6845 will generally perform on the EGA at the level provided by the previous adapter. The EGA provides downward compatibility with the CGA and MDA for supported modes. Thus, applications using special features unique to the 6845 CRTC may not run predictably on the EGA.

DISPLAY ATTRIBUTES When the video display adapters are operating in one of the text modes, each displayed

Table A: Register Descriptions for the MDA and CGA CRT Controller*

| Register index | Register usage |
|----------------|---------------------------|
| 0 | Horizontal total |
| 1 | Horizontal displayed |
| 2 | Horizontal sync position |
| 3 | Horizontal sync width |
| 4 | Vertical total |
| 5 | Vertical total adjust |
| 6 | Vertical displayed |
| 7 | Vertical sync position |
| 8 | Interface mode |
| 9 | Maximum scan line address |
| A | Cursor start |
| B | Cursor end |
| C | Start address high |
| D | Start address low |
| E | Cursor address high |
| F | Cursor address low |
| 10 | Light pen high |
| 11 | Light pen low |

*The Motorola 6845.

Table C: The MDA Display Attributes

| Background | | | Foreground | | | Appearance |
|------------|---|---|------------|---|---|----------------------------------|
| R | G | B | R | G | B | |
| 0 | 0 | 0 | 0 | 0 | 0 | Nondisplay |
| 0 | 0 | 0 | 0 | 0 | 1 | Underline |
| 0 | 0 | 0 | 1 | 1 | 1 | White character/black background |
| 1 | 1 | 1 | 0 | 0 | 0 | Reverse video |

character requires 2 bytes of video memory. One byte contains the ASCII code representing the character, and the second contains the display attribute. The contents of the display attribute tell the display adapter how the character is to appear.

The breakout of the attribute byte is shown in Figure A. The foreground and background colors are controlled by the 3 bits labeled R, G, and B. The bit labeled I creates a high-intensity or bright version of the selected color. The BL bit causes the character and background to blink. The attribute byte is usually represented as a hexadecimal number where the first digit is the background and the second digit is the foreground.

The MDA decodes the attribute byte in one of four ways: normal, reverse-vi-

Figure A: The Attribute Byte



sity and the V stands for video.

The CGA interprets the attribute byte in terms of colors. Here, the RGB code directly represents turning on the RED, GREEN, and BLUE dots on the color display. (Composite displays transmit the RGB information differently, but the effect is the same.) In combination with the intensity bit, 16 foreground color combinations are possible. These combinations and their IRGB codes are shown in Table D. Since the background color lacks the intensity bit, it is limited to the colors 0 through 7, but the fourth bit can be used for BLINK.

On the CGA, the BLINK bit can be programmed to act as an intensity bit for the background by writing the value 09h to register 3D8h, thus providing the full 16 color combinations. This register is

not supported by the EGA, however, and is one example of programming the 6845 chip directly that does not produce the same result on the EGA.

The EGA decodes the attribute byte in the same fashion as the CGA. The foreground and background colors each use 3 bits and the blink and intensity bits bring the total to 8. This provides a maximum of 16 color combinations, just as in the CGA. Where, then, does the talk of the 64-color EGA palette come from?

THE ATTRIBUTE CONTROLLER

The video output connector on the EGA contains six video drive lines. The CGA has four and the MDA has only two. Thus, the EGA is able to send 2⁶, or 64, separate signal combinations to the Enhanced Color Display. This 6-bit color

Table D: The CGA Display Attributes

| I | R | G | B | Color |
|---|---|---|---|---------------|
| 0 | 0 | 0 | 0 | Black |
| 0 | 0 | 0 | 1 | Blue |
| 0 | 0 | 1 | 0 | Green |
| 0 | 0 | 1 | 1 | Cyan |
| 0 | 1 | 0 | 0 | Red |
| 0 | 1 | 0 | 1 | Magenta |
| 0 | 1 | 1 | 0 | Brown |
| 0 | 1 | 1 | 1 | White |
| 1 | 0 | 0 | 0 | Gray |
| 1 | 0 | 0 | 1 | Light blue |
| 1 | 0 | 1 | 0 | Light green |
| 1 | 0 | 1 | 1 | Light cyan |
| 1 | 1 | 0 | 0 | Light red |
| 1 | 1 | 0 | 1 | Light magenta |
| 1 | 1 | 1 | 0 | Yellow |
| 1 | 1 | 1 | 1 | Bright white |

eo, underline, or nondisplayed. These can be combined with the blink and intensity attributes to enhance the appearance of the display. The bit combinations to produce these attributes are shown in Table C. Other combinations not listed will produce varying results on the MDA and the monochrome mode of the EGA. The video output to the monitor is represented as IV, where the I stands for inten-

Table E: The EGA RGBrgb Default (SPECTRUM) Palette Values

| R | G | B | r | g | b | SPECTRUM code | Color |
|---|---|---|---|---|---|---------------|---------------|
| 0 | 0 | 0 | 0 | 0 | 0 | 00 | Black |
| 0 | 0 | 1 | 0 | 0 | 0 | 10 | Blue |
| 0 | 1 | 0 | 0 | 0 | 0 | 20 | Green |
| 0 | 1 | 1 | 0 | 0 | 0 | 30 | Cyan |
| 1 | 0 | 0 | 0 | 0 | 0 | 40 | Red |
| 1 | 0 | 1 | 0 | 0 | 0 | 50 | Magenta |
| 1 | 0 | 0 | 0 | 1 | 0 | 42 | Brown |
| 1 | 1 | 1 | 0 | 0 | 0 | 70 | White |
| 0 | 0 | 0 | 1 | 1 | 1 | 07 | Gray |
| 0 | 0 | 1 | 1 | 1 | 1 | 17 | Light blue |
| 0 | 1 | 0 | 1 | 1 | 1 | 27 | Light green |
| 0 | 1 | 1 | 1 | 1 | 1 | 37 | Light cyan |
| 1 | 0 | 0 | 1 | 1 | 1 | 47 | Light red |
| 1 | 0 | 1 | 1 | 1 | 1 | 57 | Light magenta |
| 1 | 1 | 0 | 1 | 1 | 1 | 67 | Yellow |
| 1 | 1 | 1 | 1 | 1 | 1 | 77 | Bright white |



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■ PC LAB NOTES

("Display Adapter Evolution" continued)

code can be represented as "rgbRGB". The rgb signals turn on the colors at 1/2 intensity (secondary) and the RGB signals turn on the colors at 1/2 intensity (primary). Each color may be displayed in four intensities: off, 1/4, 1/2, or 3/4.

But while the EGA can output 64 separate video color combinations, the attribute byte is still limited to the 4 IRGB bits. A specialized piece of EGA hardware, the Attribute Controller (the CGA and MDA don't have one), allows each of the 16 video memory combinations to represent a specific video color combination. Any 4-bit IRGB attribute in video memory can be set to produce a 6-bit rgbRGB code of your choice at the video connector. The Attribute Controller maintains a translation table and performs the attribute mapping for you.

The 4-bit IRGB color code corresponds to the "palette register number," and the 6-bit color code that it produces is called the "palette value." The locations in the Attribute Controller that contain the translation table are called "palette registers."

When the EGA is initialized, such as after a mode set, the palette registers are loaded with the default 6-bit rgbRGB codes. The initial palette values are located in the EGA ROM BIOS and shown in Table E. The EGA BIOS provides for changing these values (as well as other parameters) by accessing them through a pointer. Our programs can create a new table in memory and, by aiming the

pointer at them, cause our parameters to become the default. The process is similar to the way memory-resident programs attach themselves to interrupts. The palette registers can also be changed individually through a BIOS call or by programming the Attribute Controller.

The EGA can produce 64 colors only when it is connected to an Enhanced Graphics Display or a variable scan mon-

■ While the EGA can output 64 video color combinations, the attribute byte is limited to the 4 IRGB bits.

itor such as the NEC MultiSync. But the EGA can also be paired with a regular color or monochrome monitor. When it is, the limiting factor is the number of video drive lines that go to the display. Since the color display has only four lines, IRGB, it is capable of producing only the original 16 CGA colors. (Some displays, in fact, lack the intensity bit and so are limited to eight colors.) Each of the 16 palette registers of the EGA may be mapped to any IRGB attribute, allowing colors to be substituted. The monochrome monitor, with its two video lines,

provides even less opportunity for enhancement.

THE EGA BIOS The EGA BIOS has all the information needed to allow the display adapter to function in a PC. Encoded in this ROM (read-only memory) are font tables, video parameters, and assembly code routines, which programs can call to perform display-related functions. Besides being easier than operating the EGA through register manipulation, use of the BIOS routines gives programs the best chance of running successfully in different environments. Hardware implementations of the EGA standard vary considerably between manufacturers, but all strive to make their adapters compatible at the BIOS level.

The video BIOS calls available on the EGA are a superset of the video calls provided on the system board ROM. New calls have been added to support the additional functions of the EGA. To find out more about the EGA BIOS and registers, the IBM *Enhanced Graphics Adapter* manual is a must. Have your credit card ready and call IBM at (800) 426-7282. Tell them you want to order the manual, *Enhanced Graphics Adapter*, part number 6280131. The cost is \$9.95, plus about \$5.00 shipping. You'll find explanations of the registers, tables of parameters, and a full BIOS listing. (I may knock IBM for a lot of things, but try getting a BIOS listing from a compatible maker!)—Robert L. Hummel

however, may change the palette registers directly and bypass SPECTRUM entirely. If this happens, don't panic. Simply press Ctrl-<Grave Accent> and SPECTRUM will restore your palette choice when it pops up. Press Esc to return to your application.

There are no mode restrictions on running SPECTRUM at the command line to set the color palette, so it can be executed from programs that operate in graphics mode to change the displayed colors. The graphics modes do not use the color palette in the same way as the text modes, however, so you may have to experiment to get

the desired effect. While SPECTRUM will not pop up in a graphics mode, this restriction was imposed only to keep the program size down. Ambitious programmers could modify the assembly language listing to provide this capability.

The text modes with fewer than 80 columns will cause the right half of the window to overlap the left part, and you will not be able to see all the colors. I allowed this for two reasons. First, popping up SPECTRUM after a mode change should be allowed, in order to restore the screen colors from the selected palette, even in the 40-column mode. Second, if you have

used modes 0 or 1 to invoke a special EGA mode (such as the 120-column mode described by Charles Petzold in *PC Magazine*, Volume 5 Number 15, for example), SPECTRUM will allow you to work within that mode.

PATCHING THE HOT KEY Probably the most difficult part of designing a TSR utility is picking a hot-key combination to activate it. Many applications make extensive use of the keyboard, thus leaving few combinations unassigned. If your favorite word processor uses the Ctrl-<Grave Accent> combination as a Delete Page com-

Keyboard Scan Codes for Alternative Hot Keys

| Key | Scan code in hex |
|-------------|------------------|
| Esc | 01 |
| 1 | 02 |
| 2 | 03 |
| 3 | 04 |
| 4 | 05 |
| 5 | 06 |
| 6 | 07 |
| 7 | 08 |
| 8 | 09 |
| 9 | 0A |
| 0 | 0B |
| - | 0C |
| = | 0D |
| Backspace | 0E |
| Tab | 0F |
| Q | 10 |
| W | 11 |
| E | 12 |
| R | 13 |
| T | 14 |
| Y | 15 |
| U | 16 |
| I | 17 |
| O | 18 |
| P | 19 |
| [| 1A |
|] | 1B |
| Enter | 1C |
| Ctrl | 1D |
| A | 1E |
| S | 1F |
| D | 20 |
| F | 21 |
| G | 22 |
| H | 23 |
| J | 24 |
| K | 25 |
| L | 26 |
| ; | 27 |
| ' | 28 |
| ~ | 29 |
| Left Shift | 2A |
| Right Shift | 2B |

| Key | Scan code in hex |
|-------------|------------------|
| Z | 2C |
| X | 2D |
| C | 2E |
| V | 2F |
| B | 30 |
| N | 31 |
| M | 32 |
| < | 33 |
| > | 34 |
| ? | 35 |
| Right Shift | 36 |
| PrtSc | 37 |
| Alt | 38 |
| Spacebar | 39 |
| Caps Lock | 3A |
| F1 | 3B |
| F2 | 3C |
| F3 | 3D |
| F4 | 3E |
| F5 | 3F |
| F6 | 40 |
| F7 | 41 |
| F8 | 42 |
| F9 | 43 |
| F10 | 44 |
| NumLock | 45 |
| ScrollLock | 46 |
| Home | 47 |
| Up Arrow | 48 |
| PgUp | 49 |
| Left Arrow | 4A |
| Right Arrow | 4B |
| End | 4C |
| Down Arrow | 4D |
| PgDn | 4E |
| 0 | 4F |
| 1 | 50 |
| 2 | 51 |
| 3 | 52 |
| 4 | 53 |

Table 1: The Make Scan Keycodes.

mand, however, you can change SPECTRUM.COM to use any hot key of your choice. The assembly language listing of SPECTRUM has two equates in the beginning, labeled "HOTKEY" and "SHIFT_MASK". Changing these equates and re-assembling will produce a new version of SPECTRUM that makes use of your designated hot key.

If you don't happen to have an assembler, you can still patch SPECTRUM using DEBUG. The value used for HOTKEY is the "make-scan code" of the key as reported by the keyboard interrupt, INT 9. Table 1 contains a list of the "make" scan codes for each of the keys on the PC's

keyboard and, thus, gives you one of the two numbers you will need to change using DEBUG.

The second part of the hot-key combination is its shift status. There are four shift keys on a PC keyboard: Alt, Ctrl, Left Shift, and Right Shift. (The IBM enhanced keyboard has two Alt and Ctrl keys, but, for our purposes, they generate the same scan code.) The SHIFT_MASK value is determined by which shift keys must be pressed at the same time, in combination with the hot key, to activate SPECTRUM. Table 2 contains the information that you will need to determine the value to use for SHIFT_MASK.

Now you're ready to patch SPECTRUM.COM directly using DEBUG. Follow the example below, substituting your selected scan code where you see SS and the shift mask code where you see MM. All numbers are hex, and you don't have to type anything to the right of the semicolons.

```
DEBUG SPECTRUM.COM
E 171 SS ;Scan code
E 17B MM ;Shift mask
W
Q
```

HOW SPECTRUM WORKS The assembly listing of SPECTRUM is well commented, and even novice programmers can benefit from reading it. Several of the fundamental operations in SPECTRUM deserve a more extended discussion, however.

MEMORY RESIDENCY When a .COM format program is loaded under current versions of DOS, it is assigned all available memory. This is the amount of free memory reported by the CHKDSK utility. Normally, programs perform their function and terminate, releasing all the as-

SHIFT-MASK Value Table

| SHIFT-MASK Value | Shift key (● = Pressed) | | | |
|------------------|----------------------------|------|------------|-------------|
| | Alt | Ctrl | Left Shift | Right Shift |
| 0 | | | | |
| 1 | | | | ● |
| 2 | | | ● | |
| 3 | | | ● | ● |
| 4 | | ● | | |
| 5 | | ● | | ● |
| 6 | | ● | ● | |
| 7 | | ● | ● | ● |
| 8 | ● | | | |
| 9 | ● | | | ● |
| A | ● | | ● | |
| B | ● | | ● | ● |
| C | ● | ● | | |
| D | ● | ● | | ● |
| E | ● | ● | ● | |
| F | ● | ● | ● | ● |

Table 2: The SHIFT_MASK Keycodes.

■ PC LAB NOTES

Table 3: The EGA INFO Byte*

| Bit | Meaning |
|-----|--|
| 7 | High bit of mode set. 0 if screen buffer cleared during last mode change. 1 if contents preserved. |
| 6,5 | Memory installed on EGA. 6,5 = 0,0 64K = 0,1 128K = 1,0 192K = 1,1 256K |
| 4 | Reserved |
| 3 | 0 if EGA is the active monitor |
| 2 | 1 if wait for display enable |
| 1 | 1 if EGA has monochrome display attached |
| 0 | 0 if cursor emulation active |

*The byte is located at 0:487h and contains the information shown above.

signed memory back to DOS. This memory may be assigned again and again as different programs are executed, just as a diskette may be reused when its files are erased.

With memory-resident programs, however, the final call to DOS is the "Terminate and Stay Resident" (TSR) function. This call tells DOS how much memory should be permanently removed from the memory pool. The next program that DOS loads will not overwrite the saved area. SPECTRUM uses this method to leave a portion of itself in memory. In addition to the program itself, memory is reserved for the screen save/restore function and to store the current color assignments. A program that simply stayed resident, however, would do little more than waste RAM. Some method must be provided to activate the program when appropriate.

POP-UP FUNCTION Each time a key is pressed, the keyboard generates an INT 9 to pass control to the BIOS. Normally, the BIOS responds by translating the scan code sent from the keyboard into ASCII and stuffing it in the keyboard buffer. SPECTRUM splices into INT 9 by saving the current interrupt handler address and substituting the address of its own keyboard routine. This is done with the DOS interrupt 21h functions 25h (Set Interrupt Vector) and 35h (Get Interrupt Vector) when SPECTRUM is first executed. SPECTRUM may now examine any keystroke before it gets to the BIOS.

If the scan code passed by the INT 9 indicates that the designated hot key has been pressed, the status of the shift keys is checked through the BIOS INT 16h. If,

and only if, a Ctrl key is the only other key depressed, is it interpreted as a request to pop up. Other combinations will cause control to be returned to the previous keyboard handler.

The pop-up ability of a TSR program is a two-edged sword. While knowing when to pop up is important, so is knowing when not to. SPECTRUM must thus include some anti-pop-up features. The most obvious thing to avoid is having SPECTRUM pop up inside itself. A 1-byte location in memory (ACTIVE in the .ASM listing) is used to signal the state of SPECTRUM. Normally, this location contains a value of zero. When SPECTRUM detects a Ctrl-<Grave Accent> combination and prepares to pop-up, it checks this location first. If ACTIVE still contains the value 0, the process is allowed to continue and a 1 is stored in ACTIVE to indicate a busy condition. If ACTIVE is not 0, SPECTRUM assumes it is already active, and the keystroke is ignored.

If you are operating on a two-monitor system, SPECTRUM will pop up only when the EGA is the active monitor. The active monitor may be determined by examining a byte located at 0:487h, maintained by the EGA BIOS. The coding of the INFO byte (as it is called in the EGA BIOS listing) is shown in Table 3. By examining this byte, our programs can configure themselves to work more intelligently with the display hardware. If no EGA is present, the INFO byte will usually contain 0.

Because DOS was never meant to support multitasking, most DOS routines are nonreentrant. Thus, TSR programs that use DOS functions lead to frozen ma-

chines and frequent reboots. While SPECTRUM itself uses only BIOS functions in its pop-up mode, potential conflicts with DOS and other resident programs caused me to take a more conservative approach.

THE DOS CRITICAL FLAG In order to prevent SPECTRUM from popping up when DOS is busy, an undocumented DOS function is used to obtain the address of the "DOS Critical Flag." This is a 1-byte area in low memory that DOS uses to signal that it is in an uninterruptible state and no DOS calls should be made. While using undocumented functions is, predictably, frowned upon by Microsoft, I've personally tested the function call successfully in all PC-DOS versions from 2.0 to 3.3, and as long as we use tested versions, we're safe. (SPECTRUM's .COM file format most likely won't be supported under the new protected-mode DOS, so using an undocumented function will be the

■ In order to prevent SPECTRUM from popping up when DOS is busy, an undocumented DOS function is used to obtain the address of the "DOS Critical Flag."

worries.) The address of the Critical Flag is retrieved and saved when SPECTRUM is installed. Each time the hot-key combination is pressed, this byte is checked for a busy signal.

Locking out SPECTRUM whenever the DOS critical flag was up would ensure maximum safety, but it would also mean that SPECTRUM could not pop up inside programs that used the DOS keyboard input functions. This includes DEBUG, ED-LIN, and DOS itself. Allowing such a blanket restriction would severely curtail the utility of SPECTRUM and is fortunately unnecessary. Because of the way that

DOS operates internally, interrupt 21h functions 01h through 0Ch can be worked through with no ill effects. Splicing into the DOS INT 21h function call allows us to set an internal flag, `LO_FN_FLAG`, to nonzero when DOS is using one of these low-numbered function calls. Thus, if the DOS Critical Flag is set but the `LO_FN_FLAG` is set as well, SPECTRUM will still pop up.

The interception of the interrupt 21h calls is transparent to the system with the exception of function 0, "Program Terminate." This function requires that the CS register contain the segment of the Program Segment Prefix (PSP) of the program to be terminated. (See the DOS *Technical Reference* manual for more information.) Suffice it to say that when SPECTRUM intercepts INT 21h it changes the CS value, so a Program Terminate call would fail and cause DOS to halt with a memory allocation error. SPECTRUM works around this problem by substituting function 4Ch, "Terminate A Process," for function 0. This substitution has the same effect as the original function call and is transparent to the calling applications program.

SCREEN HANDLING One measure of a pop-up utility is its ability to save and restore the screen. All of SPECTRUM's screen handling is performed through the BIOS video service interrupt 10h. The current cursor location and video page are saved in local storage. Then, the SCREEN procedure is called to copy the contents of the screen where the dialogue window will appear, to an internal buffer.

The SCREEN procedure has a dual purpose and takes advantage of the similarity of the save and restore operations to save code. The contents of the SI and DI registers determine if a screen save or restore is to be performed. The workshores of the procedure are the BIOS video functions 8 (Get Character and Attribute) and 9 (Write Character and Attribute).

After the information is saved, a dialogue box is created with the BIOS Scroll Window function. The default color is inverse video for the monochrome mode 7, and white on blue for all other modes. A border is drawn around the window using the IBM line-drawing characters. In addition, the window is labeled with the pro-

gram name and version, and a help line is added at the bottom.

The `COLOR_BARS` procedure constructs the remainder of the window display. It loops through the 16 individual palettes and draws the display from left to right. The display is redrawn each time a color is changed. (Only the numbers above the color bars need to be changed, but

■ **The SCREEN**
procedure has a dual
purpose and takes
advantage of the similarity
of the save and restore
operations to save code.

splitting `COLOR_BARS` into two separate procedures would make the program larger.) For reference, the palette register number is displayed below the color bar area as a two-digit decimal number. Then, the palette value (in the hexadecimal rgbRGB format) is retrieved from the scratch buffer, `NEW_COLORS`. The EGA BIOS function "Set Individual Palette Register" is called with the register number and palette value to program the Attribute Controller. (This is, in fact, the only EGA-specific call in the program.) The palette value is then translated into SPECTRUM format and displayed above the color bar area. Finally, the procedure `DRAW_BAR` is called to draw two rows of four block graphic characters (ASCII 219). The blocks are drawn with the color number below them as the foreground color and appear solid.

PALETTESETS Three complete sets of palette values are stored inside SPECTRUM. The first contains the default EGA color palette. These are the colors you see when you boot up or when you press Home while in the dialogue window. The second contains the current color palette. This palette stores the last set of colors saved with the End key or loaded from the

command line. When SPECTRUM executes for the first time, it loads the current palette with the values in the default. The third set is the scratch set. When you pop up SPECTRUM, it makes a scratch copy of the current palette. All color changes are made to the scratch copy and don't become permanent until you press the End key. The Esc key restores the current palette.

It's possible to customize SPECTRUM to use your personal color palette as the default palette by changing the values listed after `DEFAULT_COLORS` in the source code. Pressing Home when inside the SPECTRUM window will load the new default colors. Note, however, that the color values in the .ASM listing are in hexadecimal rgbRGB and are not the same as the numbers shown in the SPECTRUM window.

RESPONDING TO COMMANDS The SPECTRUM procedure handles the keyboard when the window is active and keeps track of the arrow cursor beneath the color bars. Keystrokes are retrieved using the BIOS INT 16h function. The Esc character is the only ASCII character recognized. All the other control keys use the extended ASCII code returned by the BIOS. There aren't many ways to interpret keyboard input except to repeatedly compare and jump, and the coding is relatively straightforward. Every effort was made to reuse common code in order to keep the .COM file size down.

PREVENTING MULTIPLE LOADS When SPECTRUM.COM is executed, it searches all PC memory below its current location for its copyright notice. If it finds a match, it assumes that a resident copy of SPECTRUM already exists and does not load again. Thus, you can execute SPECTRUM as often as you like without using additional memory.

COMMAND LINE ARGUMENTS Besides preventing multiple loads, locating a resident copy of SPECTRUM is important when command line arguments are included. These arguments, which represent the desired color palette, are loaded directly into the memory reserved by the resident copy of SPECTRUM and become the new current colors.

FINALLY!

EASYFLOW

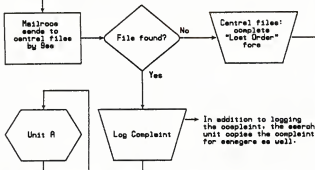
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* March 10, 1987 issue, page 276

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PRODUCTIVITY

■ PC LAB NOTES

SPECTRUM requires command line arguments to follow a specific format. Sixteen two-digit palette values must be entered, separated by a single space. When SPECTRUM is loaded, DOS provides an area at offset 81h into the PSP that contains any arguments entered after the program name. The byte at PSP:80h contains the number of characters in the command line, starting with the space after the program name but not including the final carriage return.

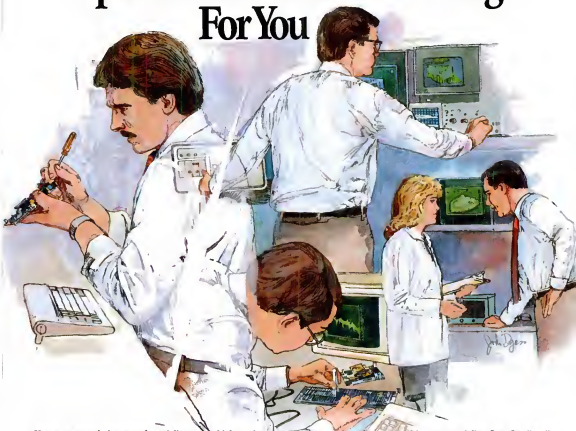
If the arguments are valid, there will be 48 characters after the program name, and the byte at PSP:80h will contain 48. If fewer than 48 characters are indicated, the arguments are ignored. Thus, a partial palette cannot be loaded with this method. More than 48 characters are considered valid to allow for trailing blanks or comments on the line. If the argument count is valid, the ASCII characters are read from the PSP buffer.

Early versions of SPECTRUM displayed the palette value in hexadecimal. But the numbers had no intuitive association with the function of the keys or the combination of colors. I decided to develop my own code to represent the rgbRGB color combinations. The leftmost number of the code (10's digit) represents the RGB combination of the 2/3, or primary, intensity colors. The rightmost number (1's digit) represents the rgb combination of the 1/3, or secondary, intensity colors. Thus, 20 represents GREEN, and 21 through 27 are shades of green. As the arguments are read from the command line, they are translated from ASCII characters to hexadecimal numbers representing the true palette value.

CONCLUSION Colorization of old black-and-white movies is controversial, but applying the same principle to EGAs is a world of fun. After you've worked out the ideal color palette for your PC, I believe that you'll wonder how you lived without SPECTRUM. Maybe as more software developers begin to take advantage of the EGA, SPECTRUM will no longer be necessary, but until then, it's the next best thing. [E]

Robert L. Hummel has recently joined the staff of PC Magazine as senior technical editor.

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CIRCLE 241 ON READER SERVICE CARD

■ PROGRAMMING/UTILITIES ■ MICHAEL J. MEFFORD

YOUR EVERY DAY REMINDER

Take charge of your time more effectively with your own resident REMINDER. Missed meetings and deadlines that take you by surprise will be a thing of the past.

Most good memory-resident utilities pop up when called, do their job, then disappear without intruding further on your work. REMINDER's task is a little more obtrusive. While it discreetly hides a list of your day's appointments a keystroke away, it doesn't let you forget them. It alerts you audibly at each time you designate, and in case you're out of earshot when it signals, it pops up its appointment window at your next keystroke as a backup warning. Additionally, if you like, it will tuck a continuous date/time display (with optional hourly chime) in the upper right corner of your screen. If you've ever worked straight through an important meeting, you'll want to get REMINDER.

As usual, the easiest way to get a copy of REMINDER.COM is to download it by modem from the PC Magazine Interactive Reader Service, as explained in the accompanying sidebar. If you prefer to enter the program yourself, the assembler source code is listed in Figure 1, and Figure 2 is a BASIC program that will create REMINDER.COM when you first run it. Both REMINDER.ASM and REMINDER.BAS are also available for modem downloading from PC-IRS.

The syntax for installing REMINDER.COM is

```
REMINDER [f],[b],[s],[h],[a]
```

The optional *f*, *b*, *s*, *h*, and *a* parameters allow you to select foreground and border colors (see Table 1), the scan code for different Alt-key combinations (Alt-R is the

default) to pop up the display window (see Table 2), and the frequencies for the hour and appointment chimes (Table 3). If you enter REMINDER without specifying your own parameters, the program defaults to the following:

```
REMINDER 7,112,19,2217,2968
```

Note that a single space must separate the command name from the optional parameter string and that all parameters are decimal numbers separated by commas. Parameters can be omitted in the series. To change the default white-on-black foreground to blue on light blue, and the black-on-white border to blue on black, you would enter

```
REMINDER 49.1
```

Similarly, if you wanted to change only the

frequency of the default hourly chime from 2217 Hz to the lower tone of 1760 Hz, you would enter

```
REMINDER ...1760
```

To keep the code length within enterable limits, parameter values are not checked, and no provision is made for changing the command line variables once REMINDER is installed. This means that in order to try a different configuration, you will have to reboot.

After deciding on the default variables you wish to use, the obvious place to put REMINDER is as a line in your AUTOEXEC.BAT file. If you have a peripheral board with a battery-powered clock and have a system clock update program (ASTCLOCK, for example) in your AUTOEXEC.BAT, be sure to install REMINDER after that program. Otherwise,



Table 1: Color Codes

| Color adapter | | | | | Monochrome adapter | | | | |
|---------------|------------|---------|------------|---------------|--------------------|------------|--------------|--|--|
| Foreground | Background | Color | Foreground | Color | Foreground | Background | Color | | |
| 0 | 0 | Black | 8 | Gray | 0 | 0 | Black | | |
| 1 | 16 | Blue | 9 | Light Blue | 7 | 112 | White | | |
| 2 | 32 | Green | 10 | Light Green | 15 | N/A | Bright White | | |
| 3 | 48 | Cyan | 11 | Light Cyan | | | | | |
| 4 | 64 | Red | 12 | Light Red | | | | | |
| 5 | 80 | Magenta | 13 | Light Magenta | | | | | |
| 6 | 96 | Brown | 14 | Yellow | | | | | |
| 7 | 112 | White | 15 | Bright White | | | | | |

Add the foreground color to the background color to arrive at the parameter number. For example, cyan (light blue) on blue would be $48 + 1 = 49$. Defaults are 7 (white on black) for the reminder field (foreground) and 112 (black on white) for the frame (border).

■ PROGRAMMING/UTILITIES

your AUTOEXEC.BAT should include the DOS TIME and DATE commands somewhere before REMINDER. While REMINDER keeps track of time changes on screen, it does not update the date display until you reboot.

USING REMINDER When you press Alt-R (or another "hot key" you have selected), a window pops up so you can enter the time of your appointments. (See the accompanying screen shot.) REMINDER displays the time in the 12-hour format, suppressing nonsignificant leading zeros. For example, 2 o'clock, whether A.M. or P.M., is displayed—and must be en-

tered—as 2:00 and *not* as 02:00. Since REMINDER determines it's time to ring the appointment chime by matching a time in the user entry field of the window exactly with the time display by the clock in the upper right corner, be sure to omit leading zeros. A.M. or P.M. must also be correctly included. REMINDER uses the convention that 12 noon is 12:00 P.M. and 12 midnight is 12:00 A.M. One minute past midnight is displayed as 0:01 A.M.

The arrow keys on the keypad can be used to navigate within the window. You can edit your appointment entries by typing over letters, or you can use the Backspace key to erase. The Home key takes

you to the beginning of a line and the End key to the end. Pressing Enter puts you at the start of the next line, though you need not use it to record your entries. F1 deletes the current line (useful for handling cancelled or completed appointments), and F2 inserts a new line, moving down entries on the current line and below. This helps not only in squeezing in a last-minute appointment but in keeping your list chronological. Note, however, that REMINDER can hold only ten appointments at once. If you insert a line in a full REMINDER, the bottom event is shoved off and lost.

When you've noted down the events you want to be reminded of, press either Esc or Alt-R and the window will disappear. You can then forget about your schedule and put full concentration on your work, with confidence that when the time of your appointment arrives, REMINDER will remind you with a chime. To distinguish it from the regular hourly chime, the appointment chime is a higher tone. If you enter an appointment time that falls on the hour, the appointment chime takes precedence. And even if you're away from your desk when the reminder tone sounds, when you return, at your next keystroke (it doesn't have to be the hot key) REMINDER will pop up the window and put its cursor on your appointment.

F3 and F4 are toggle keys that enable or disable the hourly alarm and on-screen time display. If the hourly reminder drives you cuckoo, you will want to take advantage of F3. F4, the date/time display toggle, will come in handy if REMINDER is competing with an application for the upper right corner for data display. Simply pop up REMINDER and press F4 to suspend the date/time display until you are done with the current project; it does not need to be enabled for the alarm and pop-up reminder to function.

UNDERSTANDING REMINDER All of REMINDER's power and versatility are packed into 1700 bytes. The information for the window structure, the double-line graphic characters used for the border and the field descriptors and delimiters, and the function key definitions are all compressed. The window displaces 720 bytes (16 rows by 45 columns) for characters and another 720 bytes for the color attri-

Table 2: Scan Codes for Alt Combinations

| Key | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | - | = |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Code | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 |

| Key | Q | W | E | R | T | Y | U | I | O | P |
|------|----|----|----|----|----|----|----|----|----|----|
| Code | 18 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |

| Key | A | S | D | F | G | H | J | K | L |
|------|----|----|----|----|----|----|----|----|----|
| Code | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 |

| Key | Z | X | C | V | B | N | M |
|------|----|----|----|----|----|----|----|
| Code | 44 | 45 | 46 | 47 | 48 | 49 | 50 |

The default is 19 (Alt-R). Data is arranged in rows to correspond with the typewriter keyboard.

Table 3: Tone/Frequency Correlation

| Tone | Frequencies (in Hz by octave) | | | | | | | | | |
|------|-------------------------------|-----|-----|-----|------|------|------|-------|-------|--|
| A# | 55 | 110 | 220 | 440 | 880 | 1760 | 3520 | 7040 | 14080 | |
| A | 58 | 117 | 233 | 466 | 932 | 1857 | 3714 | 7428 | 14856 | |
| B | 62 | 123 | 247 | 494 | 988 | 1976 | 3952 | 7904 | 15808 | |
| C | 65 | 131 | 262 | 523 | 1046 | 2093 | 4186 | 8372 | 16744 | |
| C# | 69 | 139 | 277 | 554 | 1109 | 2217 | 4434 | 8868 | 17736 | |
| D | 74 | 149 | 294 | 587 | 1175 | 2349 | 4698 | 9396 | 18792 | |
| D# | 78 | 156 | 311 | 622 | 1245 | 2489 | 4978 | 9956 | 19912 | |
| E | 82 | 165 | 330 | 659 | 1319 | 2637 | 5274 | 10548 | 21096 | |
| F | 87 | 175 | 349 | 698 | 1397 | 2794 | 5588 | 11176 | 22352 | |
| F# | 93 | 185 | 370 | 740 | 1480 | 2960 | 5920 | 11840 | 23680 | |
| G | 98 | 196 | 392 | 784 | 1568 | 3136 | 6272 | 12544 | 25088 | |
| G# | 104 | 208 | 415 | 831 | 1661 | 3322 | 6644 | 13288 | 26576 | |

Middle C is 262. The defaults are 2217 (C#) for the hourly chime and 2960 (F#) for the alarm chime.

[illegible][illegible]

(continued)

Figure 1: The assembly language source code for creating REMINDER.COM.

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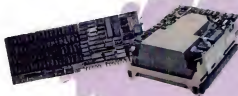
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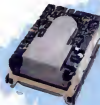
Of course many of you will want to take advantage of the EGA card right away, so we are also offering a special "Display Deal" -- the EGA board together with the Basic Time HR31-350 monitor, for only \$599. We mentioned the EGA features above; the Basic Time HR31-350 monitor features 640x350 resolution, full 14" RGB picture with .31mm dot pitch, and a tilt/swivel base.

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CIRCLE 236 ON READER SERVICE CARD

■ PROGRAMMING/UTILITIES

```

=====
; Display M801
MOV DL,"P" ;show display PB.
MOV DI,OFFSET WINDOW+16 ;adjust it over 12.
CMP AX,12
JMP DISPLAY_HOKE
MOV AX,12
JMP [DI]
MOV DI,12
MOV HL,1
CALL STORE_NUMBER

;settime time low.
MOV AX,CX
MOV DX,00
MOV CX,1000
DIV CX ;and divide by 1000 counts
; per minute.
MOV DX,0 ;don't suppress leading zero.
CALL SUPPRESS_CURRENT_MINUTE.
CALLS STORE_NUMBER
MOV AX,CX ;check if new minute has gone by.
JMP TIME_HOKE ;if no, skip.
MOV WATCH_FLAG,0 ;if yes, reset watch flag.

;=====
; Display time unless disabled or in graphics mode.
;=====
TIME_HOKE: CMP DISPLAY_FLAG,0 ;skip display if display flag low
JZ CR_WATCH ;skip also if in graphics mode.
MOV DI,2559
MOV CX,1
CALL WRITE_SCREEN

;=====
; Update the current date and time with
; alarm date and time (time in window.
;=====
CR_WATCH: CMP WATCH_FLAG,1
JZ CR_WATCH
MOV AX,10
MOV DI,OFFSET WINDOW+274 ;check the 10 possible time
; display lines of time with
; the current time.
MOV DI,10
MOV CX,3 ;there are 3 bytes in time field.
ROR CL,3
JZ WATCH ;if match, skip.
ADD DI,0F
SBC AX
JNB COMP_TIME

;=====
; If we didn't get a match with watch
; alarm, see if the hour has changed.
;=====
COMP_TIME: CMP WATCH_FLAG,1
JZ CR_WATCH
MOV AX,10
MOV DI,OFFSET WINDOW+274
MOV DI,10
MOV CX,3
ROR CL,3
JZ WATCH ;if match, skip.
ADD DI,0F
SBC AX
JNB COMP_TIME

;=====
; If we didn't get a match with watch
; alarm, see if the hour has changed.
;=====
HOURLY_ALARM: CMP ALARM_FLAG,0 ;skip if hourly alarm is disabled
JZ CR_WATCH
MOV AX,10
MOV DI,OFFSET WINDOW+274
MOV DI,10
MOV CX,3
ROR CL,3
JZ WATCH ;if match, skip.
ADD DI,0F
SBC AX
JNB COMP_TIME

;=====
; If we have a match, time message again.
;=====
MATCH: CMP WATCH_FLAG,0 ;is the message since done?
JZ EXIT_TIMER
MOV AX,10
MOV DI,OFFSET WINDOW+274
MOV DI,10
MOV CX,3
ROR CL,3
JZ WATCH ;if match, skip.
ADD DI,0F
SBC AX
JNB COMP_TIME

;=====
; If we have a match, time message again.
;=====
EXIT_TIMER: POP DI ;restore registers
POP DI
POP DI
POP DI
POP DI
POP DI
JMP CR_WATCH_TIMER

;=====
; This subroutine clears the watch on and off for the alarm.
;=====
HALL: CMP HALL_COUNT,14*2 ;toggle the speaker on and off
JZ START_HALL
MOV AL,HALL
MOV AL,11111111
MOV DI,0
MOV HALL_COUNT,0
MOV DI,0
MOV LAST_MOVE,0
MOV WATCH_FLAG,1
JMP START_HALL

;=====
; This first time through?
;=====
START_HALL: CMP HALL_COUNT,0
JZ TOGGLE_HALL
MOV AL,HALL
MOV AL,11111111
MOV DI,0
MOV HALL_COUNT,0
MOV DI,0
MOV LAST_MOVE,0
MOV WATCH_FLAG,1
JMP START_HALL

;=====
; This first time through?
;=====
TOGGLE_HALL: CMP HALL_COUNT,0
JZ TOGGLE_HALL
MOV AL,HALL
MOV AL,11111111
MOV DI,0
MOV HALL_COUNT,0
MOV DI,0
MOV LAST_MOVE,0
MOV WATCH_FLAG,1
JMP START_HALL

;=====
; This first time through?
;=====
TOGGLE_HALL: CMP HALL_COUNT,0
JZ TOGGLE_HALL
MOV AL,HALL
MOV AL,11111111
MOV DI,0
MOV HALL_COUNT,0
MOV DI,0
MOV LAST_MOVE,0
MOV WATCH_FLAG,1
JMP START_HALL

```

(Figure 1 continues)

"...for a straight database, I'll take Condor."

— Jerry Pournelle

Author and Reviewer
Writing in InfoWorld

And no wonder. Since its introduction Condor 3, the fully relational database management system designed for the PC user, has been added to as many as 200,000 systems.

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■ PROGRAMMING/UTILITIES

[illegible]

(Figure 1 ends)

bute of the characters, a total of 1440 bytes. Most of these character bytes are the space character that defines the initially empty entry field positions. To keep the BASIC data listing as short as possible, all the spaces are squeezed out of the window structure. REMINDER then fills a reserved window buffer full of spaces and sprinkles the border and text characters in their appropriate locations. Every other byte of the window is a color attribute byte that is also filled out during installation. An equal-sized buffer of 1440 bytes is reserved to store the current screen contents so that REMINDER can restore the original display. The reserved screen buffer starting location is given the same address as the start of the installation code. (The installation procedure is used only once, so this same memory can be used for part of the buffer to store the screen contents.) REMINDER displaces about 1680 bytes

of RAM for code, including the trapped 256 bytes of the PSP (program segment prefix) and another 2880 bytes for the two window buffers, a total of 4560 bytes—or about 4.5K of resident RAM.

During installation, REMINDER inserts its code into the stream of things by taking the two hardware interrupts most commonly used by resident programs. These two interrupts are the keyboard, INT 9H (which I'll discuss more in a moment), and the timer, INT 1CH. (INT 8H is the actual hardware interrupt for the timer, and 1CH is the user interrupt vector that is called by INT 8H to perform any user-desired functions.) The timer interrupt occurs 18.2 times per second to call on the BIOS to update the system clock stored in the BIOS data area. The reserved storage for the clock is a double word in low RAM, starting at 40:6CH. During each timer interrupt, REMINDER also gets

control and retrieves this double word count of the system clock. During its turn, REMINDER converts the high and low words of the timer into the 12-hour time format and writes it directly to the screen buffer. This same information is then stored in the pop-up window storage so REMINDER can compare the current time with the time you enter for your appointments.

If no match is found, REMINDER exits and returns control back to the timer interrupt routine. If a match is found, REMINDER prepares to ring the appointment chime. There are two ways to pulse the speaker. One is through software, which involves having your program sit in a loop that toggles the speaker on and off very quickly. The other is to take advantage of the hardware, that is, a chip on the system board. The 8253 programmable timer chip has three different timers in it, one of

which is directly connected to the speaker. Whether or not this connection is actively oscillating the speaker depends on the 8255 programmable peripheral interface chip.

Simply speaking, the 8255 is the switch for the 8253. The rate or frequency at which the 8253 pulses the speaker is dependent on a divisor that must be loaded into the chip. This divisor is an inverse function of the number you enter on the command line for the hourly and/or appointment chimes. Once the 8253 has been programmed for the desired frequency, REMINDER tells the 8255 to tell the 8253 it's time to pulse the speaker. REMINDER then turns control back to the timer interrupt. Five hundredths of a second later (1/18.2) another timer interrupt occurs and this time REMINDER turns the speaker off. On the next tick of the system clock, REMINDER again turns the speaker on. This toggling on/off continues 14 times

and the result is a chime-like sound. The total length of the chime, then, is $14 * 2$ (on and off) / 18.2 or approximately 1.5 seconds.

THE FAMILIAR INT9 With every keystroke, both depression and release, the keyboard gets the microprocessor's attention by issuing INT 9H. Normally INT 9H passes control directly to the BIOS to interpret the keystroke. Installing REMINDER, however, changes the interrupt vector table, so that control comes to REMINDER instead. The first thing REMINDER's keyboard interrupt routine does is push the flags on the stack; it then issues a far call to the original keyboard interrupt vector that REMINDER displaced, i.e., to the BIOS. Interpreting keystrokes is a long and burdensome task, and is best left to the well-written BIOS routine. When the BIOS is finished and has put the keystroke in the keyboard buffer, it issues an IRET and

control is returned to REMINDER.

REMINDER then proceeds down a checklist to see if it should pop up the window. The first item checked is a flag called BUSY, which indicates (as I'll explain more fully shortly) whether or not REMINDER is already popped up. If REMINDER is not BUSY, that is, the window is not popped up, it checks to see if we are in graphics mode. Code to reprogram the video controller chip to text mode was not included in REMINDER. If the current video mode is text, REMINDER then checks to see if the timer routine has rung the appointment chime. If true, REMINDER pops up the window. Otherwise, the last thing checked is whether or not the keystroke was the hot key. If any of the above criteria are not met, REMINDER issues an IRET and control is passed on to whoever is next in line, be it another TSR, an applications program, or COMMAND.COM.

```

000 OPEN "***** BASIC PROGRAM TO CREATE BENCHMARK.COM
010 REM "*****" PROGRAM AS 01 LEN 32
020 FOR I=1 TO 256
030 CHECKSUM = 0
040 FOR J=1 TO 254
050 LINENO = 0
060 FOR K=1 TO 8
070 HEAD BYTES
080 CHECKSUM = CHECKSUM + BYTE
090 LINENO = LINENO + BYTE
100 NEXT K
110 IF (BYTE * 256) THEN LET AS = CHR(BYTE)
120 PUT AS
130 NEXT J
140 NEXT I
150 READ LINENO
160 IF LINENO <= LINENO THEN PRINT "Error in Line",256 + 10
170 NEXT I
180 END
190 *****
200 IF CHECKSUM = 370959 THEN PRINT "Successful Completion!" : END
210 REM "*****" COM file is not valid!" : END
220 *****
230 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
240 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
250 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
260 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
270 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
280 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
290 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
300 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
310 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
320 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
330 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
340 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
350 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
360 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
370 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
380 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
390 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
400 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
410 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
420 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
430 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
440 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
450 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
460 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
470 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
480 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
490 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
500 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
510 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
520 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
530 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
540 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
550 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
560 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
570 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
580 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
590 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
600 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
610 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
620 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
630 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
640 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
650 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
660 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
670 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
680 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
690 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
700 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
710 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
720 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
730 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
740 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
750 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
760 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
770 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
780 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
790 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
800 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
810 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
820 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
830 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
840 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
850 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
860 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
870 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
880 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
890 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
900 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
910 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
920 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
930 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
940 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
950 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
960 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
970 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
980 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
990 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62
1000 DATA 189, 283, 184, 116, 32, 49, 57, 56, 62

```

| | | | | | | | | | |
|----------|------|------|------|------|-------|------|------|------|------|
| 738 DATA | 74, | 1, | 129, | 251, | 76, | 116, | 179, | 68, | 807 |
| 739 DATA | 32, | 136, | 17, | 414, | 173, | 128, | 251, | 63, | 874 |
| 740 DATA | 80, | 157, | 117, | 255, | 128, | 128, | 128, | 128, | 874 |
| 741 DATA | 80, | 80, | 117, | 255, | 232, | 334, | 8, | 187, | 980 |
| 742 DATA | 1, | 22, | 275, | 8, | 235, | 147, | 128, | 918, | 918 |
| 743 DATA | 14, | 14, | 14, | 14, | 14, | 14, | 14, | 14, | 918 |
| 744 DATA | 80, | 80, | 139, | 22, | 76, | 1, | 232, | 103, | 731 |
| 745 DATA | 14, | 80, | 14, | 80, | 14, | 187, | 14, | 14, | 918 |
| 746 DATA | 16, | 139, | 138, | 93, | 1, | 80, | 128, | 38, | 918 |
| 747 DATA | 80, | 80, | 1, | 80, | 93, | 95, | 94, | 88, | 548 |
| 748 DATA | 80, | 157, | 76, | 157, | 80, | 157, | 80, | 157, | 80 |
| 749 DATA | 76, | 141, | 76, | 1, | 142, | 216, | 14, | 689, | 689 |
| 750 DATA | 76, | 157, | 76, | 157, | 80, | 157, | 80, | 157, | 80 |
| 751 DATA | 76, | 157, | 76, | 157, | 80, | 157, | 80, | 157, | 80 |
| 752 DATA | 76, | 157, | 76, | 157, | 80, | 157, | 80, | 157, | 80 |
| 753 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 754 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 755 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 756 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 757 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 758 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 759 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 760 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 761 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 762 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 763 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 764 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 765 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 766 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 767 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 768 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 769 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 770 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 771 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 772 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 773 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 774 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 775 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 776 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 777 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 778 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 779 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 780 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 781 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 782 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 783 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 784 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 785 DATA | 117, | 251, | 238, | 236, | 1469, | 1, | 216, | 251, | 1309 |
| 786 DATA | 117, | 251, | 238, | 2 | | | | | |

(continues)

Figure 2: A BASIC program that will automatically produce REMINDER.COM.

■ PROGRAMMING/UTILITIES

| | | | | | | | | | |
|-----------|-----|-----|-----|-----|-----|-----|------|------|-------|
| 1330 DATA | 1 | 116 | 3 | 190 | 140 | 3 | 195 | 3 | 648 |
| 1330 DATA | 8 | 144 | 71 | 223 | 185 | 251 | 191 | 239 | 139 |
| 1330 DATA | 30 | 8 | 80 | 83 | 82 | 86 | 87 | 535 | |
| 1340 DATA | 252 | 14 | 31 | 104 | 64 | 8 | 142 | 192 | 879 |
| 1350 DATA | 30 | 140 | 73 | 8 | 8 | 8 | 119 | | |
| 1360 DATA | 110 | 38 | 68 | 3 | 116 | 6 | 60 | 7 | 370 |
| 1370 DATA | 216 | 2 | 177 | 3 | 126 | 14 | 82 | 1 | 535 |
| 1380 DATA | 30 | 134 | 140 | 8 | 30 | 101 | 118 | 689 | |
| 1390 DATA | 8 | 163 | 80 | 1 | 14 | 7 | 179 | 65 | 589 |
| 1400 DATA | 8 | 164 | 8 | 216 | 7 | 61 | 11 | 338 | |
| 1410 DATA | 210 | 2 | 279 | 80 | 191 | 234 | 11 | 61 | 878 |
| 1420 DATA | 12 | 239 | 3 | 65 | 32 | 126 | 32 | 8 | 336 |
| 1430 DATA | 29 | 331 | 129 | 12 | 181 | 3 | 232 | 330 | 1457 |
| 1440 DATA | 8 | 139 | 193 | 51 | 210 | 185 | 69 | 4 | 851 |
| 1450 DATA | 247 | 241 | 140 | 8 | 138 | 14 | 336 | 12 | 184 |
| 1460 DATA | 232 | 22 | 8 | 50 | 193 | 116 | 5 | 198 | 180 |
| 1470 DATA | 6 | 80 | 1 | 8 | 128 | 62 | 96 | | |
| 1480 DATA | 8 | 116 | 19 | 228 | 62 | 52 | 1 | 419 | |
| 1490 DATA | 114 | 22 | 190 | 196 | 11 | 191 | 118 | 8 | 834 |
| 1500 DATA | 185 | 31 | 6 | 232 | 35 | 246 | 128 | 62 | 917 |
| 1510 DATA | 90 | 1 | 2 | 116 | 70 | 184 | 18 | 8 | 481 |
| 1520 DATA | 187 | 168 | 12 | 191 | 222 | 11 | 139 | 243 | 1131 |
| 1530 DATA | 185 | 7 | 8 | 242 | 167 | 116 | 31 | 212 | 889 |
| 1540 DATA | 185 | 80 | 72 | 157 | 238 | 128 | 62 | 89 | 991 |
| 1550 DATA | 8 | 8 | 134 | 14 | 163 | 80 | 59 | 472 | |
| 1560 DATA | 6 | 82 | 2 | 116 | 65 | 138 | 30 | 98 | 510 |
| 1570 DATA | 1 | 232 | 52 | 8 | 235 | 16 | 138 | 62 | 748 |
| 1580 DATA | 90 | 1 | 8 | 117 | 29 | 242 | 216 | 5 | 785 |
| 1590 DATA | 33 | 8 | 134 | 224 | 178 | 37 | 163 | 74 | 821 |
| 1600 DATA | 3 | 190 | 15 | 3 | 190 | 6 | 3 | 190 | 6 |
| 1610 DATA | 90 | 1 | 2 | 139 | 30 | 161 | 1 | 232 | 596 |
| 1620 DATA | 14 | 8 | 2 | 54 | 58 | 69 | 93 | 80 | 583 |
| 1630 DATA | 7 | 31 | 157 | 40 | 255 | 6 | 60 | | |
| 1640 DATA | 238 | 82 | 84 | 1 | 20 | 127 | 23 | 228 | 671 |
| 1650 DATA | 97 | 36 | 238 | 97 | 36 | 238 | 97 | 36 | 238 |
| 1660 DATA | 1 | 8 | 161 | 80 | 1 | 163 | 82 | 1 | 489 |
| 1670 DATA | 100 | 8 | 90 | 1 | 190 | 128 | 62 | 681 | |
| 1680 DATA | 84 | 1 | 8 | 137 | 22 | 176 | 182 | 238 | 812 |
| 1690 DATA | 87 | 186 | 18 | 8 | 53 | 182 | 243 | 1884 | |
| 1700 DATA | 238 | 68 | 139 | 196 | 68 | 139 | 196 | 68 | 139 |
| 1710 DATA | 36 | 252 | 238 | 97 | 228 | 97 | 52 | 3 | 995 |
| 1720 DATA | 238 | 97 | 252 | 6 | 84 | 3 | 195 | 178 | 1846 |
| 1730 DATA | 238 | 240 | 488 | 8 | 128 | 255 | 190 | | |
| 1740 DATA | 8 | 116 | 6 | 68 | 48 | 117 | 2 | 176 | 525 |
| 1750 DATA | 3 | 178 | 21 | 178 | 132 | 159 | 132 | 159 | 132 |
| 1760 DATA | 3 | 195 | 252 | 128 | 62 | 138 | 8 | 768 | |
| 1770 DATA | 136 | 32 | 190 | 138 | 8 | 191 | 93 | 1 | 753 |
| 1780 DATA | 185 | 8 | 232 | 1 | 242 | 7 | 195 | | |
| 1790 DATA | 27 | 138 | 68 | 44 | 117 | 3 | 78 | 235 | 674 |
| 1800 DATA | 232 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1810 DATA | 226 | 233 | 176 | 32 | 136 | 30 | 95 | 1 | 930 |
| 1820 DATA | 187 | 148 | 31 | 119 | 251 | 185 | 251 | 2 | 1178 |
| 1830 DATA | 243 | 171 | 176 | 285 | 18 | 248 | 11 | 23 | 14874 |
| 1840 DATA | 1 | 1 | 192 | 48 | 18 | 232 | 251 | 8 | 732 |
| 1850 DATA | 193 | 54 | 17 | 232 | 138 | 8 | 8 | 8 | 8 |
| 1860 DATA | 7 | 385 | 5 | 8 | 173 | 248 | 3 | 768 | |
| 1870 DATA | 291 | 172 | 68 | 8 | 118 | 4 | 178 | 71 | 844 |
| 1880 DATA | 235 | 247 | 228 | 248 | 185 | 22 | 8 | 173 | 1310 |
| 1890 DATA | 138 | 248 | 3 | 251 | 272 | 181 | 148 | 248 | 1481 |
| 1900 DATA | 4 | 173 | 238 | 248 | 3 | 251 | 272 | 181 | 1481 |
| 1910 DATA | 18 | 8 | 178 | 131 | 199 | 89 | 228 | 258 | 1875 |
| 1920 DATA | 254 | 286 | 137 | 227 | 148 | 93 | 1 | 19 | 1328 |
| 1930 DATA | 149 | 11 | 105 | 43 | 8 | 178 | 71 | 228 | 1875 |
| 1940 DATA | 252 | 203 | 11 | 191 | 75 | 3 | 232 | 178 | 1136 |
| 1950 DATA | 178 | 131 | 199 | 4 | 254 | 287 | 217 | 248 | 1138 |
| 1960 DATA | 185 | 2 | 8 | 191 | 123 | 16 | 178 | 71 | 768 |
| 1970 DATA | 242 | 182 | 161 | 118 | 8 | 787 | | | |
| 1980 DATA | 82 | 6 | 128 | 6 | 78 | 1 | 148 | 6 | 614 |
| 1990 DATA | 6 | 163 | 76 | 1 | 61 | 168 | 3 | 498 | |
| 2000 DATA | 6 | 128 | 6 | 78 | 1 | 148 | 6 | 614 | |
| 2010 DATA | 184 | 9 | 37 | 385 | 32 | 137 | 38 | 46 | 717 |
| 2020 DATA | 184 | 9 | 37 | 385 | 32 | 137 | 38 | 46 | 717 |
| 2030 DATA | 285 | 33 | 127 | 38 | 62 | 1 | 148 | 6 | 614 |
| 2040 DATA | 64 | 1 | 186 | 65 | 4 | 164 | 28 | 37 | 568 |
| 2050 DATA | 285 | 33 | 148 | 143 | 37 | 285 | 29 | 380 | 1880 |
| 2060 DATA | 42 | 385 | 33 | 186 | 198 | 58 | 228 | 274 | |
| 2070 DATA | 180 | 13 | 8 | 232 | 287 | 254 | 1275 | | |
| 2080 DATA | 138 | 14 | 58 | 228 | 183 | 8 | 232 | 198 | 1223 |
| 2090 DATA | 284 | 139 | 183 | 65 | 188 | 1 | 61 | 188 | 187 |
| 2100 DATA | 8 | 114 | 3 | 45 | 188 | 8 | 232 | 182 | 676 |
| 2110 DATA | 254 | 68 | 171 | 3 | 248 | 225 | 198 | 144 | 327 |
| 2120 DATA | 1 | 3 | 248 | 185 | 3 | 8 | 164 | 71 | 167 |
| 2130 DATA | 228 | 252 | 195 | 185 | 43 | 8 | 178 | 71 | 1142 |
| 2140 DATA | 228 | 252 | 195 | 185 | 43 | 8 | 178 | 71 | 1142 |
| 2150 DATA | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2160 DATA | 18 | 8 | 51 | 218 | 247 | 227 | 139 | 1888 | |
| 2170 DATA | 216 | 3 | 222 | 219 | 232 | 139 | 195 | 395 | 1438 |
| 2180 DATA | 18 | 8 | 82 | 182 | 185 | 185 | 118 | 1888 | 617 |
| 2190 DATA | 180 | 116 | 8 | 346 | 8 | 84 | 185 | 185 | 195 |
| 2200 DATA | 181 | 8 | 284 | 8 | 65 | 112 | 122 | 111 | 785 |
| 2210 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2220 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2230 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2240 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2250 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2260 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2270 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2280 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2290 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2300 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2310 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2320 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2330 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2340 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2350 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2360 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2370 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2380 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2390 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2400 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2410 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2420 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| 2430 DATA | 181 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |

(Figure 2 ends)

Otherwise, REMINDER prepares to pop up the window by going through another list of chores. First the BUSY flag is set so that REMINDER won't try to re-en-

ter itself. The date/time flag is enabled so that when the window pops up, the clock will be displayed. The keystroke that initiated REMINDER to pop up is retrieved

from the keyboard buffer and discarded. The contents of the screen that REMINDER is going to write over with the pop up window are saved. And finally the cursor type and position are saved so REMINDER can use the cursor in its window. When all this is done—and it all happens in a wink of an eye—the window is popped up on the screen by writing directly to the screen buffer and the cursor is moved into the window.

An interesting chain of events happens next. Once the window is up, REMINDER waits for your instructions by issuing INT 16H function zero. This BIOS interrupt is a short routine that sits in a loop, constantly checking if there is anything in the keyboard buffer. It's the BIOS routine of INT 9H, remember, that is responsible for placing our keystroke in that buffer. REMINDER has placed its vector in place of the BIOS INT 9H routine so when you strike a key, INT 9 comes knocking at REMINDER's front door. REMINDER calls on the INT 9 BIOS routine to interpret the keystroke and place the result in the key-

CB: U 1.17

Reminder

4-86-87 Mon 3:58 PM

| | A | B | C | D | E |
|----|-----------------|---|------|-----|-------------------|
| 1 | UPS PROJECT | | | | |
| 2 | Wave Shape | | | | |
| 3 | Factor 1 Normal | | | | |
| 4 | BACK-UP XT REF | | | | |
| 5 | WAVE LOAD | | | | |
| 6 | | | | | |
| 7 | UPS-81 | 1 | 1.17 | 121 | |
| 8 | UPS-82 | 1 | 1.24 | 125 | |
| 9 | UPS-83 | 1 | 1.19 | 124 | |
| 10 | UPS-84 | 1 | 1.09 | 125 | |
| 11 | UPS-85 | 1 | 1.28 | 125 | |
| 12 | UPS-86 | 1 | 1.27 | 125 | |
| 13 | UPS-87 | 1 | 1.23 | 122 | |
| 14 | UPS-88 | 1 | | | |
| 15 | | | | | |
| 16 | UPS-89 | 1 | 0.50 | 124 | 132 128 132 1 94 |
| 17 | UPS-10 | 1 | 0.68 | 122 | 125 123 125 1 100 |
| 18 | UPS-11 | 1 | 1.21 | 125 | 126 131 126 1 103 |
| 19 | UPS-12 | 1 | 1.19 | 125 | 126 127 128 1 104 |
| 20 | UPS-13 | 1 | 0.90 | 125 | 125 122 135 1 104 |

| Time | Appointment |
|----------|---------------------------------|
| 8:15 AM | Coffee break |
| 8:30 AM | Fred Peterson |
| 10:15 AM | Another coffee break |
| 11:00 AM | Buy 200 shares of Jiffy Lube |
| 11:30 AM | Lunch with Ms. Falterson |
| 1:00 PM | As the World Turns |
| 2:15 PM | Tea time |
| 3:30 PM | Aerobics |
| 4:45 PM | Check MCI mail |
| 5:00 PM | Pick up qt. of milk on way home |

| | | | | |
|----|-------------|----|--------------|---------|
| F1 | Delete Line | F2 | Hourly Alarm | Enabled |
| F3 | Insert Line | F4 | Time Display | Enabled |

Breaking the 640K DOS Barrier:

New version of Alsys PC AT Ada* compiler improves speed, adds application developer's guide, brings seven 80286 machines to latest validation status.



Alsys' landmark Ada compiler for the PC AT, the first to bring Ada to popular-priced microcomputers, has been upgraded to Version 1.2 with significant improvements.

The new version compiles faster than its predecessor, is validated for a full range of popular compatibles using the latest AJPO test suite 1.7, and includes a Developer's Guide in the documentation set. The price remains at \$2,995 for single units, including a 4 megabyte RAM board.

Both the original and the newly upgraded versions utilize the inherent capabilities of the 80286 chip and "virtual mode" to eliminate the 640K limitations of DOS. These techniques permit addressing up to 16 MB of memory, under the control of DOS, without changes to DOS in any way!

80286 machines validated in the new release include HP's Vectra, Compaq's Deskpro 286, Sperry's PC/IT, Zenith's 200 series (including the Z-248), Tandy's 3000 HD, the Goupil/40, and the IBM PC AT. The compiler supports DOS 3.0 or higher. Ada programs compiled on the AT will also run on PCs and XT's supporting DOS 2.1 or higher.

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■ PROGRAMMING/UTILITIES

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The modem number for PC-IRS is (212) 696-0360. Set your modem and communications software to use 1200 (or 300) bps, 8 data bits, 1 stop bit, no parity. PC-IRS files with a .COM, .EXE, or

.ARC extension require that you also use the Xmodem error-checking protocol; our other files (e.g., with extensions of .ASM or .BAS) can be downloaded using either regular ASCII or Xmodem transmission.

REMINDER.BAS, whether typed in from the magazine at your keyboard or downloaded from PC-IRS, will automatically create REMINDER.COM when run once in BASIC. REMINDER.ASM, also listed both here and on PC-IRS, allows you to modify the program but requires you to use a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```
MASM REMINDER;  
LINK REMINDER;  
EXE2BIN REMINDER REMINDER.COM
```

REMINDER AT A GLANCE

REMINDER is a memory-resident utility that: (1) alerts you to scheduled appointments by sounding an alarm and by popping up its appointment list at the next keystroke thereafter, and (2) displays the date and time in the upper right corner of the screen and sounds an hourly chime. The (2) functions above may be disabled.

The program may be loaded with its default parameters by simply entering its name at the DOS prompt or as a line in an AUTOEXEC.BAT file. To change the default parameters, use the following syntax when loading:

```
REMINDER [f,]b[,s,]h[,a]
```

where *f* and *b* are the desired foreground and border colors, *s* is the scan code for the desired trigger key, and *h* and *a* are

the frequencies of the desired hourly and appointment chimes. (See the text for tables of appropriate values for these parameters.)

When loaded, Alt-R (default) opens the appointment notepad for entering activities. In entering times, enter 2:00, not 02:00, and be sure to include the A or P before the M in the window. The use of the F1 through F4 function keys is indicated in the window. Editing within the window uses overstrike and a destructive backspace. Pressing either Esc or Alt-R closes the window.

REMINDER should be loaded after any system time/date setting routines in an AUTOEXEC.BAT file, and should precede loading *SideKick* (if used). REMINDER is a well-behaved memory-resident program, but, as with all TSR utilities, complete compatibility with all programs cannot be assured.

with the scan code and ASCII character of this keystroke in the AX register. The BIOS has come knocking at our front door through INT 9H with the keystroke only to find REMINDER already busy, and the BIOS INT 16H returns by the back door with the same keystroke to REMINDER. The reason for this bizarre path is so REMINDER can pop down the window with the same hot key. If the BIOS were let in at the front door with a hot-key response, REMINDER would attempt to pop up the already popped-up window. The stack would grow uncontrollably and it all would become a real mess.

Next, REMINDER evaluates the value of AX returned via INT 16H. If the keystroke is an ASCII response (this is determined by the value of the AL register), REMINDER calls on the routine to handle display of your entry. If AL is zero then the response is an extended keystroke. An extended code is generated if the arrow keys, function keys, or either the Alt or Ctrl key is depressed while pressing another key. REMINDER checks to see if the extended code returned matches any of those in its own keyboard dispatch table. REMINDER has a special subroutine to handle ten

■ Once REMINDER is resident, it can no longer make DOS calls and thus update the date.

extended keys. These are the four arrow keys, Home, End, and the first four function keys. If REMINDER finds a match for any of these keys in its table, a corresponding offset of the appropriate subroutine is called on to handle the keystroke request. For example, if the Right Arrow key is struck, the cursor, if not already in the last column, is moved one column to the right.

I won't prolong this discussion by going into detail about all these subroutines; they're amply described in the assembly listing. Instead, I want to tell you another story about REMINDER concerning inter-

board buffer. On return, REMINDER sees that the BUSY flag is set, so it quickly exits with an IRET.

This puts the interrupted BIOS INT

16H routine back in charge. It immediately finds a keystroke available—namely, the one that the BIOS INT 9H routine put there. INT 16H returns to REMINDER

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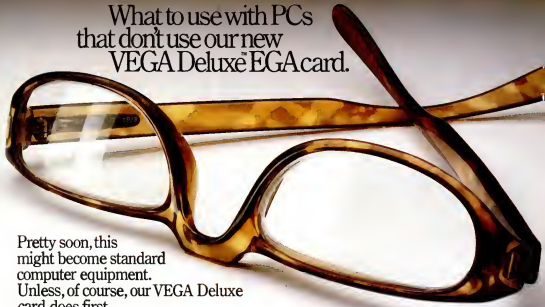
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■ PROGRAMMING/UTILITIES

X-RATED XDIR

Several readers have encountered difficulties when using the XDIR utility published here in Volume 6 Number 7. As a result, a new version of the program has been posted on the PC Magazine Interactive Reader Service. If you downloaded the program prior to April 9, replace it with the updated version.

If you typed in XDIR from the magazine and do not have a modem to use with PC-IRS, we will send you the revised version (.COM and .ASM files) if you send a disk and a self-addressed, post-age-paid mailer to:

NEW XDIR
PC Magazine
One Park Avenue
New York, NY 10016

Jeff Prossie, the author of XDIR, has submitted the following explanation:

As originally published, XDIR's interrupt 13h handling routine inadvertently altered the flags register passed back from the BIOS, causing certain diskette operations (such as the DOS FORMAT command) to fail for no apparent reason. Thanks are due to Charles Copeland and John Mullis, who first notified me of the problem and suggested a cure.

A second problem was recognized and reported by several readers. XDIR employed the auxiliary timer interrupt (interrupt 1Ch) when it should have attached itself to the primary one (interrupt 8). While the effects of this probably never showed up on your system, the potential for a crash was there because XDIR

sent its own EOI signal to the 8259. The BIOS interrupt 8 handler sends an EOI immediately after regaining control from interrupt 1Ch, so any interrupt being serviced when XDIR's timer routine stepped in was in danger of being ended prematurely.

In retrospect, the best solution is to avoid the timer interrupt altogether. The revised XDIR relocates the code responsible for checking the internal DOS flag and popping up the window inside the keyboard interrupt routine.

As we often point out when publishing memory-resident (TSR) utilities, there are some applications that will be inherently incompatible with it. Thus, for example, some readers have reported trouble using XDIR with QuickBASIC 2.0. QuickBASIC takes over interrupt 9 to detect the press of certain key combinations not recognized by the BIOS. In such situations, the only answer would be to take the SideKick approach of monitoring the interrupt 9 vector and grabbing it back if another program steals it. To adopt such a procedure would violate the ground rules for well-behaved TSRs, however, and would render XDIR incompatible with SideKick itself.

While we do our best to ensure that all the programs in this column are well-nigh bulletproof, occasionally difficulties such as these will arise. Our apologies to those who may have been inconvenienced, and our thanks to the alert readers whose comments and suggestions pointed the way to the solution.—Ed.

own stack. DOS then carries out the request, function 9H (print a string), for example. When the string is printed, the two values saved for the stack segment and its pointer, which were saved in memory on entry, are replaced. Now, if a TSR such as REMINDER were to interrupt DOS on one of its missions, that is, if you pressed Alt-R while DOS was writing a string, and REMINDER then issued the DOS function call 40H (save to disk), DOS would save the stack segment and pointer in that same storage location. What would be saved are DOS's own stack pointers. DOS would then set up its stack, save the file, and, on exit, replace the stack pointers with its own pointer. The original stack would be lost and there would be a crash.

It gets more complicated. If REMINDER interrupted INT 13 (diskette I/O) or INT 25H (absolute disk read) or INT 26H (absolute disk write) and had DOS write to disk, well, you can guess what would result—a scrambled disk. There is a solution to the problem, and that is to take all these interrupts and monitor their activity. If found active, the program would refuse to pop up. This is what SideKick, the king of TSRs, is doing when you hear its four painful squeals. By using the timer tick, SideKick waits four squeals of time to see if the noninterruptible routine finishes before it gives up. This leads us back to why REMINDER only gets the date during installation and does not attempt to update at midnight. The easiest way to get the date is through interrupt 21H (DOS) function 2AH, and indeed this is what REMINDER does during installation. During installation it is safe to call on DOS. But once REMINDER is resident, it can no longer make DOS calls and thus update the date. The other solution would be to include a calendar algorithm, but there was no space in an already-long program to include that. There is actually a safe time to reenter DOS. It's when DOS issues INT 28H, the interrupt used by PRINT.COM, but I'll save that for a future article.

A COUPLE OF QUIRKS If you're up at midnight, you'll discover an interesting little trait of REMINDER. At that hour, REMINDER first changes the time from 11:59 P.M. to 12:00 A.M., at which point the hourly chime rings. A few seconds lat-

rupts. My original concept for the program included a date field in the window so you could enter appointments for a future day. Also, one of the function keys was set aside as a save-to-disk function so you could remember, for example, next Monday's dentist appointment (or so you wouldn't have to rekey your appointments if you reboot your PC during the day—Ed). And, indeed, many of you will probably wish this were a part of RE-

MINDER. One of the reasons it was not included lies in the fact that DOS is not reentrant.

THE REENTRANCY PROBLEM

You've probably heard that DOS is non-reentrant, but what does it mean and why does it affect REMINDER? When a program issues a INT 21 DOS call, DOS first saves the current stack segment and stack pointer in a memory location and sets up its



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■ PROGRAMMING

er, however, the time is changed to 0:00 A.M. REMINDER thinks the hour has changed once again so you end up getting a double chime to start the new day. Maybe it's just the weariness of the hour that enables me to appreciate rather than object to this cute little quirk.

REMINDER should be compatible with most applications. If, however, the application steals the keyboard interrupt and does not pass on your keystrokes to others, a trait of many word processors, you will not be able to pop up REMINDER. Also, REMINDER cannot pop up over a graphics display. Under these circumstances, the chimes, both hourly and

■ REMINDER's special subroutines are amply described in the assembly listing.

appointment, will, however, continue to function properly. There is one other small nuisance. When REMINDER's window opens the cursor is moved inside. On exit, REMINDER replaces the cursor where the BIOS says it was last found. Some applications, however, such as *1-2-3* and *SideKick*, do not use the BIOS to change the cursor location, but rather program the 6845 video controller chip on their own. What this means is that when you pop down REMINDER, the cursor will end up in these applications some place other than where it should be. Don't panic. Press any key and the application will update the cursor position.

Despite its inevitable limitations, I think you'll find yourself using your REMINDER every day. I know I do. I've even customized my REMINDER to work in the 26- versus 12-hour format. Those extra two hours each day are the secret of meeting copy deadlines. ☐

Michael J. Mefford is a microcomputer consultant and software designer in Glendene Beach, Oregon, and is a frequent contributor to PC Magazine.

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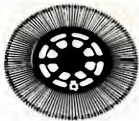
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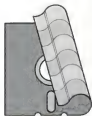
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■ JARED TAYLOR

SPREADSHEET CLINIC



Padding and underlining tricks, an undocumented way into Point mode, security for open worksheets, and making macros save files smoothly.

PADDING WITH PERIODS

In 1-2-3 you often have to create models in which there is a column of item descriptions with a column of data just to its right. In such situations I like to pad out each cell description column with periods for the entire width of the column, so that it looks like Figure 1. Doing this by hand, one cell at a time, is tedious at best.

A better way is to use the macro `\D` shown in Figure 2. It uses the `{let}` statement along with the `@cellpointer` and `@repeat` functions that are new to Release 2. Before you run the macro, put the cursor on the first cell of the column of labels you would like to pad out. After you hit Alt-D, the macro will work its way down the row until it comes to a blank cell.

The actual padding takes place in the fourth line of the macro. The second line checks for labels that are as long or longer than the current column width and skips them.

Steve Gehlen
Salem, Oregon

sheet as it appears in line 4 of the macro. The cell address D13 means only that this is where the macro was when the spreadsheet was last recalculated.

The new line 4 now does nothing more than put the contents of the cell LABEL into the current cell. LABEL contains Mr. Gehlen's padding routine, and its display also reflects where the cursor was when the spreadsheet was last recalculated. In Figure 2, it displays LABEL... because the cursor was on the range name when the spreadsheet was last recalculated. If the cursor had been on a blank cell, the display would be ERR. The `{calc}`s are necessary in macro `\G` because 1-2-3 doesn't automatically recalculate the results of `{let}`. Use `{recalc}` for a limited recalculation if you prefer.

The simplest way to pad out cells may be to avoid macros entirely. Give the range name HERE to the first cell in the column you want to pad. Then enter the last formula (the nonmacro formula) in

BEFORE

Loan
Equipment
Maintenance
Insurance
Fees
Gas

AFTER

Loan.....
Equipment.....
Maintenance.....
Insurance.....
Fees.....
Gas.....

Figure 1: Labels padded out to full column width with periods.

I like what this macro does, and the way it does it in line 4. I've written a `\G` version that runs a little faster by avoiding the `/Range Name Create`, `/Range Name Delete` routines in lines 3 and 5 of Mr. Gehlen's macro. Instead of using the range name NEXT as the first argument of the `{let}` statement, the fourth line of macro `\G` uses a string formula with the `@cellpointer` function to specify which cell to pad. The actual formula in the fourth line is to the right of the `====>` arrow, but it would be displayed in the spread-

```

\@
IF @CELLPOINTER("type")="*"!ISQUIT
  IF @LENGTH(@CELLPOINTER("content"))>@CELLPOINTER("width") @DOWN @SPACE \@
  /RCHART
  {let next,@CELLPOINTER("content")+@REPEAT(" ",@CELLPOINTER("width")-@LENGTH(@CELLPOINTER("content")))}
  @NEXT @SPACE \@
\@

\@
IF @CELLPOINTER("type")="*"!ISQUIT
  IF @LENGTH(@CELLPOINTER("content"))>@CELLPOINTER("width") @DOWN @SPACE \@
  {calc: {let next,@CELLPOINTER("content")+@REPEAT(" ",@CELLPOINTER("width")-@LENGTH(@CELLPOINTER("content")))}
  @NEXT @SPACE \@
  @DOWN @SPACE \@
}

LABEL LABEL...

Peculiar to "LABEL":
@CELLPOINTER("content")+@REPEAT(" ",@CELLPOINTER("width")-@LENGTH(@CELLPOINTER("content")))
=====
Non-macro formula:
@CELL("content",@ERR)+@REPEAT(" ",@CELL("width",@NEXT)-@LENGTH(@CELL("content",@ERR)))

```

Figure 2: Different ways to pad out the contents of a cell with periods.

■ SPREADSHEET CLINIC

Figure 2 into the cell to its right. Copy the formula down as many rows as there are cells to pad. They will all contain the label to their left and be padded with periods. Convert them into values with the */Range Values* command and then put them where you want them.

UNDERLINING LABELS

Most people underline long labels in 1-2-3 by going to the cell below and entering a string of minus signs. However, since you must enter the string in the control panel, which isn't aligned with the spreadsheet, underlining usually involves tedious character counting or trial and error. Here's a mindless way to avoid the guesswork.

Start by copying the cell to be underlined to the cell directly below it. Go to the newly created cell and hit F2 (Edit). Now the two lines displayed in the control panel will be the same, except that the top line protrudes to the right, since it also displays the cell address of the current cell. Notice which character in the first line is directly over the last character in the second line. Hit Home and then Right Arrow to get to the first character of the current label. Hold down the Minus sign key until it repeats to the point just under the character you noted in the line above it in the control panel. Now hold down the Del key until there are no more characters to the right of the cursor. Hit Enter and you're done.

David Strom
Creve Coeur, Missouri

Mindless, perhaps, but effective.

SECURING YOUR WORKSHEET

Sometimes you may need to leave your computer for a moment while you have sensitive 1-2-3 data on the screen. If you don't want people looking through the spreadsheet while you're gone, you probably save your model and then walk away. If you are not going to be away long and you don't want to bother with saving and reloading, however, you might find macro \H in Figure 3 useful. When you run it, it moves the cursor to a blank part of the spreadsheet and locks out anyone who does not enter the correct password. Though there is no control panel prompt, the macro is waiting for a label entry, which it stores in cell G2 (or any other

handy place). In this case, the correct label entry, or password, is go. Once G2 equals go, the macro ends and returns the user to the spreadsheet. It is the use of {breakoff} that makes this macro tamper-proof, since it disables Ctrl-Break as a method for aborting macros.

Burt Kitner
Montreal, Quebec
Canada

This is a clever use of {breakoff}. At Mr. Kitner's suggestion, I have written a version of the macro (\Q) that not only keeps your spreadsheet away from unauthorized eyes, but records the time (or date) every time someone tries to fool with it. This macro uses a string formula in the next-to-last line to put (a now into a new cell every time someone gives the macro the wrong password. Though the display in the line is shorter, the actual formula in the cell is to the right of the ==> arrow. If the cell named TIME (as well as the cells below it) are formatted for time, the macro will record the time of every incorrect password

attempt. You could reformat the cells for date if you wanted to leave your computer unattended for days on end.

In order for both macros to work, be sure to give the range names in the left-hand column to the cells to their right.

SAVING FILES WITH MACROS

Macros must sometimes save a 1-2-3 spreadsheet to disk. As long as the name you save under is original, the save routine goes smoothly. However, if there is already a file of that name on disk, 1-2-3 changes its file-saving routine slightly to ask if you would like to write over the existing file or cancel the save operation. Your macro may not always know what to expect, and may be thrown off by an unexpected cancel/replace option.

Macro A in Figure 4 is a routine that you can include in a longer macro that will solve the problem, at least when you are printing a file to disk. It first gets to the point where the disk file will be created (if there isn't one with that name already) or to the cancel/replace option (if there is al-

```
\H      {breakoff}{end}{home}{pgdn}
HOLDER {getlabel ,G2}
        {if G2="go"}{pgup}{quit}
        {beep}{branch HOLDER}

\Q      {end}{home}{pgdn}{braekoff}
        {paneloff}{windowsoff}
        {goto}TIME
H       {getlabel ,F3}
        {if F3="go"}{pgup}{quit}
ADDRESS {recalc ADDRESS}
        {lat $D$25,$now} =====+{let "$@CELLPOINTER("address")&",$now}"
        {down}{branch H}

TIME    04:41:19 PM
        04:41:20 PM
        04:41:27 PM
```

Figure 3: Two macros that will keep people out of your worksheet.

```
A      /pfFILENAME~{esc}{esc}{esc}{esc}{esc}{esc}
        /pfFILENAME~r
B      /pfFILENAME~r{esc}
C      /fsFILENAME~r{esc}
```

Figure 4: Macros for saving files when one with the same name might already be on the disk.



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■ FRANK J. DERFLER, JR.

CONNECTIVITY CLINIC



Cost-effective printer sharing for the LaserWriter, the X.400 standard explained, adding nodes to Omninet, and downloading laser font files too large for a floppy disk.

SHARE THAT LASER

In our department there are an equal number of PCs and Macintoshes. The Macs are networked, so that their users can share an Apple LaserWriter. Those of us with PCs would like to share the LaserWriter, too. Could you recommend a reasonably economical upgrade path that would allow a few PCs to use the LaserWriter now, then share additional printers as the demand grows?

Bruce L. Clarke
Assoc. Prof. of Chemistry
Univ. of Alberta
Edmonton, Alberta
Canada

You have several alternatives, including both the 3Com 3Server3 (the final "3" stands for Ethernet, Token-Ring, and AppleTalk compatibility) and the TOPS network from Centram Systems in Berkeley, California. I recommend the TOPS network. There are less-expensive ways to share a LaserWriter that involve manually switching the LaserWriter from AppleTalk to 9,600-bit-per-second communications and running separate printer cables, but this becomes either a dead-end path or a rat's nest of wires.

For an investment of \$389 per workstation for the PC and \$149 per workstation for the Macintosh, the TOPS alternative gives you full PC/Mac LAN capabilities, including file transfers between PCs and Macs and the ability to use the PCs as disk storage devices for the Macs. TOPS Print (\$189 per PC) gives a PC automatic access to the LaserWriter's full capabilities,

including graphics. This isn't the cheapest route, but it sure represents the best value.

WHAT'S X.400?

Lately I've seen references to "X.400" in relation to electronic mail systems. We're setting up internal and interface e-mail for our company, but I've never heard of X.400. What is it?

X.400 is a 266-page set of standards proposed by the Consultative Committee on International Telephone and Telegraph (CCITT, an agency of the United Nations) for store-and-forward message systems. Almost all of the major electronic mail and computer system vendors in Europe have adopted the X.400 standard.

U.S. vendors are under enormous pressure to offer X.400 compatibility for their U.S. e-mail offerings. MCI Communications says it will conform with X.400 for MCI Mail. The Network Courier e-mail

program, from Consumers Software, is an X.400-compatible LAN e-mail package. AT&T, Sytek, MCI, Western Digital, and other network and communications companies endorse The Network Courier as the standard e-mail program for their network system offerings.

FAX CAPABILITIES

We are interested in supplying fax machines as part of the products we market here in Nigeria. Is it possible to send documents already in paper form (for example, certificates and signatures) through fax using the PC?

O. Olagundoye Surulere
Lagos, Nigeria

Certainly. The internal fax boards for the PC (reviewed in depth in "PCs and Fax Get It Together" in this issue) can all accept data from external scanners able to convert images on paper to digital form. These scanners (reviewed in Volume 5 Number 16) can accept a wide variety of documents. You can use the same products to turn pages of paper text into data files for word processing.

GROWING OMNINET

I never realized my company's network needs would grow so fast. Six months ago we set up an Omninet LAN and already we've reached the recommended node limit of 64 stations on the cable. How do I expand the network without throwing out everything we've done so far? Also, if I run out of cable length, is there any way to extend the network?

■ A less-expensive way to share a LaserWriter involves running separate printer cables, but this can become a rat's nest of wires.



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■ CONNECTIVITY CLINIC

There are several ways to expand a given network, depending, in part, on the type of wire and the physical characteristics of the LAN. The cheapest way to extend the physical length of the cable run is to buy a repeater. A repeater is an electrical device that boosts the electrical signal on the wire through regeneration and retransmission. Generally, you can double the cable length if you use a cable repeater. However, installing a repeater does not allow you to add nodes. The number of nodes is controlled by the access protocol.

The more comprehensive and cost-effective method of extending the network is to use a network server to host two network adapter cards connected to separate cable runs. Networking software such as Banyan Systems' VINES and Novell's NetWare can usually support up to four access cards in the server. However, the Omninet cards don't use either direct memory access or interrupts, and a card can reside at only one of two memory addresses, so only two Omninet cards can sit in a server. This arrangement allows an Omninet network to handle up to 128 (2 times 64) nodes and two cable runs of 1,000 feet each.

LASER FONTS

We need to download fonts to an AST laser printer attached to a server running Novell's NetWare, but the program only runs under DOS. The files are too big for a floppy disk. Can you help?

You can download the fonts, but it requires establishing a DOS partition large enough for the font files on the server's hard disk. Here's how to proceed: Make a file-by-file backup of the hard disk. Then use option 1 on the NetWare installation program to establish a DOS partition (you might want to use this opportunity to COMPSURF the disk). Keep the NetWare partition as the bootable partition. Boot the server under DOS from a floppy disk and load the font files onto the hard disk. Run the download program and reboot under NetWare. (When reloading the fonts, just boot again from a DOS disk.)

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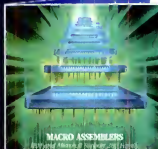
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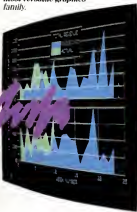
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CIRCLE 215 ON READER SERVICE CARD

■ EDITED BY CRAIG L. STARK

POWER USER



A bevy of reader tips for getting better performance and more convenience from dBASE, Microsoft Word, Lightning, WordPerfect, Power Base, and SuperKey.

SUPERKEY DISK FORMAT

To ease the process of formatting (another 100 diskettes, I developed the set of SuperKey macros shown in Figure 1.

The macro set functions as follows:

Alt-A (for Auto Start) automatically calls up the remainder of the set when the macros are loaded.

Alt-B (for Beep) is a generalized macro that sounds a short beep.

Alt-F (Format) does the actual formatting. It executes the FORMAT command for drive A: and takes care of the responses. It then repeats the FORMAT command and handles the response sequence for drive B: questions. Finally, it calls the next macro, Alt-G.

Alt-G calls Alt-B to alert us that we're ready for the next two diskettes. It then calls Alt-P (Pause).

Alt-P is a display macro that provides the instructions for continuing with the next two diskettes or terminating the process.

The termination (using Ctrl and Escape) is not very elegant, but it works.

William Tooker
Farmingdale, New York

One drawback to this set of macros is that it seems to require a hard disk to hold FORMAT.COM, which must repeatedly be loaded into memory. If you have a floppy disk system, however, you can still use this approach if you create a RAMdisk, using VDISK.SYS (or the equivalent) and put FORMAT.COM on the RAMdisk. (Even if you do have a hard disk, you still might want to use a RAMdisk in order to speed up

the loading of FORMAT.COM.)

I ran into one minor problem running Mr. Tooker's macro set. My AT wouldn't respond to the DOS clear screen command (CLS) in the Alt-G macro until after each

FORMAT command. This was easy enough to fix by adding a short delay factor between the clear screen command and the command to call up the macro Alt-B. The modified version of the Alt-G macro is

```
<BEGDEF><AltB><TITLE>Sound a Beep<TITLE>
<CMD>FB00400 00400 00100<CMD><ENDDF>
```

```
<BEGDEF><AltF><TITLE>Format A then B<TITLE>
format a:<ENTER><ENTER>n<ENTER>
format b:<ENTER><ENTER>n<ENTER>
<AltG><ENDDF>
```

```
<BEGDEF><AltG><TITLE>Pause then redo formats <TITLE>
cls<ENTER><AltB><AltP><AltF><ENDDF>
```

```
<BEGDISP><AltP> 10 3 60 15.<CtrlENTER>
You are now going to Format Two Diskettes.
Put One in Drive A: & one in Drive B:
```

When you are ready press the (ESC)ape Key to continue
(The ESCape Key ends this display)

```
When you are finished with all diskettes,
Leave Drives A and B empty
Press (CTRL) and (ESC) to terminate this process
(That is how to end a SuperKey Macro)
Then Press (ESC) to clear this display
<ENDDF>
```

```
<BEGDEF><AltA><TITLE>Auto start for formatting<TITLE>
<AUTO><AltG><ENDDF>
```

For use on an AT, David Stone suggests replacing the ALT-G macro above with:

```
<BEGDEF><AltG><TITLE>Pause then redo formats <TITLE>
cls<ENTER><CMD>dfl0<CMD><AltB><AltP><AltF><ENDDF>
```

Figure 1: A set of SuperKey macros to facilitate formatting a large group of disks.

■ POWER USER

shown at the bottom of Figure 1.

Also, those who are new to SuperKey should be forewarned that the display macro Alt-P must be created with an ASCII text editor, not with the SuperKey editor.—M. David Stone

SIDEKICK AND MICROSOFT WORD

SideKick is incompatible with my favorite screen setting for Microsoft Word. To use SideKick while running Word, however, all you have to do is use the Library Run command, followed by DATE or TIME (or some other innocuous DOS command), to reset the screen to a mode compatible with SideKick. After running SideKick, I can then hit any key to return to Word. This trick is especially useful when two or more windows are open, so that quitting Word altogether would require some time in resetting the windows.

Dwight Underhill, Sc.D.
Pittsburgh, Pennsylvania

I presume your favorite screen setting is for Word's graphics mode. At least, I sus-

up SideKick from within Word, you can use this trick to salvage the already confused screen.—M. David Stone

SUPERKEY BUG

I've discovered a subtle bug in the SuperKey macro editor. If your macro ends with the < character, SuperKey's macro editor will eat it when you try to save the macro. You can create a macro with the < character either interactively or with another text editor, but don't try to make any changes using the SuperKey macro editor.

Christopher M. Larkin
Annapolis, Maryland

A few minutes experimentation with SuperKey confirmed this bug. There's an even simpler fix, however, that does not force you to ignore the macro editor. If you need to end a macro with the < character, just add a second < character that you don't need. When you save the macro, the second < character vanishes, leaving you the single < character you wanted.

—M. David Stone

LIGHTNING AND RAMDISKS

I put all three of Lightning's dictionary files (DISK.DIC, THES.DIC, and AUX1.DIC) on a RAMdisk, using IBM's VDISK program. The Lightning manual explains the procedure very well, with one exception: the importance of sector size selection when you create the RAMdisk. I've found that simply changing the sector size from VDISK's default 128 bytes to 512 bytes shortens the average scanning time for a screen of text from 32.9 seconds to 15.6 seconds. The gains are not as large for individual word misspelling checks and thesaurus searches, but they are still substantial, with 512-byte sector RAMdisks running about 25 to 45 percent faster than 128-byte sector RAMdisks.

Thomas E. Burk
St. Paul, Minnesota

The DOS 3.2 manual itself notes that while small sector sizes waste less space if your files are small, "Better performance is achieved with a large sector size." For some users it may even make sense to create two RAMdisks, one with 128-byte sectors and one with 512-byte sectors, using each one for different purposes. Please

■ If your macro ends with the < character, SuperKey's macro editor will eat it when you try to save the macro.

ceeded in producing a problem calling up SideKick on an EGA screen in graphics mode. For those who haven't tripped across this problem, be aware that SideKick will work well enough if you call it up while running Word, but the screen will become somewhat confused—more so when you return to Word. This is true even using Version 1.56 of SideKick, which claims to have solved the problem of working with graphics-screen programs. Dr. Underhill's trick of having Word reset the screen works in 25-line mode or 43-line mode. And SideKick's calculator paste function carries over when you return to Word. Moreover, if you accidentally call



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note that you need a lot of memory to use a RAMdisk with Turbo Lighting: **DISK.DIC** and **THES.DIC** alone require 342 K. If your auxiliary dictionary grows very large, this will leave little room left for running programs, unless you have more than 640K installed. One compromise is to put the thesaurus dictionary on RAMdisk while writing or editing, and leave the spelling check for after the creative work is done.—M. David Stone

MACRO LIBRARY DIRECTORY

One drawback to WordPerfect macros is that the macro files must live in either the current directory or the same directory as WP.EXE. But since I have 130 macros, I would like to keep them in their own sub-directory.

My solution was to give all of my macros names, rather than cryptic Alt-single letter combinations, and to put my macro library in \WORD\MACROS. Then I made a macro-calling macro, Alt-M:

Alt-F10 \WORD\MACROS\

When creating Alt-M, do not hit Enter after the second Backslash. Instead, hit Ctrl-F10 to turn off the macro recorder.

Now when I want to call up a macro, I hit Alt-M, instead of Alt-F10, and then type in the name of the macro. The only macro which must still reside in the directory with WP.EXE is ALTM.MAC.

Dave Tocus
Rockville, Maryland

As noted, this trick will work only for named macros, but if you have 130 macros, you have long ago run out of single Alt-letters to use. My own preference with WordPerfect is to ignore the macro feature and use SuperKey, ProKey, or some other keyboard redefinition utility instead. These programs eliminate the clutter of macro files by putting all WordPerfect macros in a single file. They also let you edit the macros, even without the WordPerfect Library. ProKey also permits named macros.—M. David Stone

POWER BASE SPACE

Deleting records in Power Base leaves a blank space in your data files, which is re-used if needed. This means the disk file size does not get smaller when you delete

records. However, you can regain the disk space by using an undocumented feature for file redefinition.

Start by entering Define/Change mode and picking the file on which you want to work. Press Shift-F10, and Power Base will ask if you want to do a two-pass redefinition. Answer yes, and Power Base will outload the records to disk, then inload them from disk, leaving you with a smaller file that contains only the active records.

Another hidden feature that may save scrambled records is Shift-F10, also entered from Define/Change mode. Choose this, and Power Base will ask if you want to do a one-pass redefinition. Answer yes, and Power Base will rebuild the key and map files to match the data file.

In either case, be sure to use a copy of the file, rather than the original, to guard against disaster.

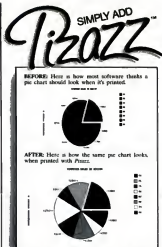
Steve Tobin
Hampton, Minnesota

I generally assume that undocumented features are undocumented because of bugs, but according to PowerBase Systems technical support, these features both work without problems. They were left hidden because they don't fit in with the rest of Power Base's command structure.

PowerBase Systems also says that these features are only in Version 2.1. Earlier versions have no equivalent. In Version 2.2 the features were removed and replaced.

The replacement is also undocumented. It comes as a standalone utility called Tools. Hard disk users who used the Power Base installation facility will find the utility installed in their PB subdirectory. Floppy disk users can create a Tools floppy disk by putting the Start disk in drive A: and typing Tools. TOOLS.BAT will install all the files on a single disk, giving instructions for changing disks and so forth.

PowerBase Systems says there are six files involved: TOOLS.BAT, TOOLS.MNU, TOOLS.EXE, TOOLS.PRM, PBCHECK.EXE, and PBMERGE.EXE. The PBCHECK module performs the same function as Shift-F9 in Version 2.1. The PBMERGE module is a new feature that lets you merge two Power Base data files into one. A last module, PBPACK, serves the same function as Shift-F10 to compact



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the file. This is not on the distribution disks, but is available on request to registered users.

PBPack is also available on the PowerBase bulletin board and can be downloaded with Xmodem. This RBBS board also includes tips for using the program. When you sign on, the system asks for a password. If you don't have one, you can still browse parts of the system, and you can leave a message to the SysOp asking for registration. The system parameters are 1200 bps, 8 data bits, no parity, 1 stop bit. The phone number is (313) 540-2812.—M. David Stone

FUNCTION KEYS IN dBASE

Though this is undocumented, dBASE III lets you set the function keys to issue control characters as well as text strings. SET FUNC 2 TO CHR(23) reprograms the F2 key to send a Ctrl-W (for exiting from a series of GETs or a full-screen EDIT). Fur-

■ dBASE III lets you set function keys to issue control characters as well as text strings.

ther, when BROWsing a wide database, it's convenient to pan right and left with SET FUNC 7 TO CHR(26) and SET FUNC 8 TO CHR(2). Just use the values in the dBASE manual under the INKEY() function for the CHR() numbers.

Paul McNamara
Longmeadow, Massachusetts

Most power users have long since customized their CONFIG.DB program to set up

their function keys automatically. A second setup for BROWsing and EDITing would also be handy.

Hitting F2 is certainly easier than a Ctrl-W or Ctrl-End, and some computer-phobes are strangely terrified by the thought of two-finger key combinations.

You can also issue multiple control codes. For example, SET FUNC 8 TO CHR(2)+CHR(2)+CHR(2) will pan right three times in BROWSE. Note that in BROWSE (only), dBASE takes over the F10 key (it issues a Ctrl-Home to call the special menu). The F1 key is normally unavailable as well.—Brad Stark

CUSTOM HELP IN dBASE II

The dBASE II help file, DBASE-MSG.TXT, is surprisingly accessible and easy to modify and expand with new keywords. It's in ASCII text, and the first entry starts with *HELP and ends with *EXIT. To add new keywords, use upper-

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case and mark the beginning and end in the same way: *KEYWORD . . . *EXIT. You can insert any amount of text in between, and dBASE will automatically format it for screen output.

When writing your main menu, you can assign the question mark as the help key. Thus, when the "?" key is pressed, dBASE will read DBASEMSG.TXT file, look for the *MAINMENU marker, and display your help message. For the second menu, the question mark can be made to execute the statement HELP MNU2. If the DBASEMSG.TXT file contains the entry *MNU2, the help message is shown. If there is no *MNU2 entry, then dBASE displays "No help messages found".

Since dBASE interprets only four characters, you could not use *MENU1 and *MENU2 as separate markers.

Gary Williams
St. Augustine
Trinidad and Tobago

■ The dBASE II help file, DBASEMSG.TXT, is surprisingly easy to modify and expand with new keywords.

Far those who care, note that doing this is contrary to your License Agreement. On the other hand, it's useful.

dBASE III tinkers, beware! III's help files are different, inscrutable, and immutable. (No one should take that as a challenge.) Inside dBASE III Plus programs, however, you can trap an F1 keypress using the INKEY() function. This, in effect,

allows you to create custom help.

Clipper programmers have it easy. When F1 is pressed in a Clipper-compiled application, the program automatically passes three parameters to the help system: the calling procedure, the pending variable, and the program line number. The programmer has complete control. The added ability to SAVE and RESTORE the screen makes seamless, context-sensitive help painless to create.—Brad Stark

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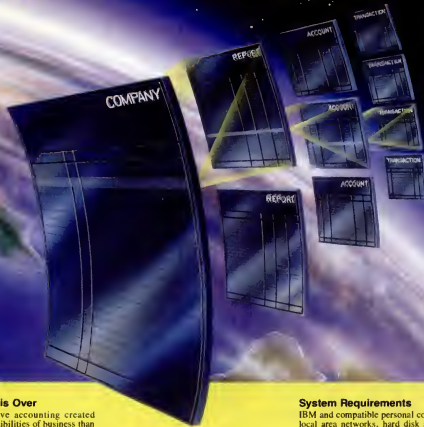
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■ PAUL SOMERSON

USER-TO-USER



Two techniques for fast, brute-force mass deletions, and an intelligent, flexible DOS appointment calendar that provides quick keyword searches.

BETTER DELETER

In Volume 6 Number 2 you presented various batch files to delete globally without facing the doubtful question "Are you sure (Y/N)?" The DELETE.COM routine, created by the assembler listing in Figure 1, or the BASIC program in Figure 2, deletes any file or group of files specified in any legal DOS path. It is substantially faster than the mentioned batch routines and even produces a tally of the files deleted. It ignores all directory entries and files with a read-only attribute.

R. Andrew Killinger
Aurora, Colorado

While nobody wants a screen cluttered with operating system chatter, DOS is a little too taciturn. DELETE.COM prints a terse report on the number of files deleted, which can prevent surprises. If you think you're erasing three or four files, and you see you've wiped out two or three dozen, this lets you reach for Norton.

DELETE's ability to ignore directories comes in handy as well. If you're in the root directory and you have a subdirectory called \BACKUP and you try to erase a file called \BACKUP.OLD but you forget to type the extension, typing

DEL \BACKUP

will produce the "Are you sure (Y/N)?" message that tells you DOS is waiting to erase a whole directory somewhere. This is because DOS interprets DEL \BACKUP as DEL \BACKUP.*.* which is clearly not what you wanted. If you get this message and don't see it or hit the wrong key, you

```

; DELETR.ASM -- FILE DELETION UTILITY
; *****
CSEG
        SEGMENT
        ASSUME  CS:CSSEG, DS:DSSEG, ES:ESSEG, SS:SSSEG
PARAMETER LABEL BYTE    ; PARAMETER IS HERE
ENTRY:   DB 0           ; ENTRY POINT

; NEXT DATA
;

DELETMSG DB "          file(s) deleted."
FILENAME DB 0
DELETSCOUNT DB 0

; BEGINNING, VERIFYING PARAMETER
;

BEGIN:  MOV     DI, 0+OFFSET STABUFFER ; DEFINING ADDR. OF STA
        MOV     AH, 1AH               ; FUNCTION TO DO THE ABOVE
        INT     21H                   ; DOS CALL
        CMP     PARAMETER, 0          ; LENGTH OF PARAMETER LIST
        JE      EXIT                  ; IF 0 THEN ERROR
        MOV     CX, 0                 ; SEED COUNTER HIGH BYTE
        MOV     CL, PARAMETER         ; LOAD LENGTH
        MOV     SI, 1+OFFSET PARAMETER ; PARAMETER STRING POINTER
        MOV     AX, CX                ; XEEP PARAMETER LIST LENGTH
        ADD     AX, SI                ; ADD OFFSET AND LENGTH
        MOV     SI, AX                ; SI POINTS TO LAST BYTE
        MOV     RDI PTR [SI], 0       ; MAKE AN ASCII STRING
        DEC     SI                    ; POINT TO LAST CHAR
        DEC     CX                    ; DEC. LENGTH BY ONE.

        STD     DI, 0+OFFSET PATHANDFILE ; SET DEC. FLAG
        MOV     LODIR ONF             ; ADDR. OF DEST.
        FINDPATH:  MOV     AL, ".*"    ; PATH SPECIF
        JE      TRANSFATH             ; ASSIGN PATH
        MOV     AL, ".*"              ; DRIVE SPECIF
        JE      TRANSFATH             ; ASSIGN PATH
        LOOP    FINDPATH              ; PROCEED NEXT CHAR.
        JRP     PROCDEE NEXT CHAR.    ; BEGIN DELETION PROCESS

; EXITING ROUTINE (CONVERTS AND PRINTS THE NUMBER OF FILES DELETED)
;

EXIT:   MOV     SI, 6+OFFSET DELETMSG ; POINTS TO LEAST SIGNIF DIGIT
        MOV     DI, OFFSET DELETMSG   ; SET POINTER TO DELETE MESSAGE
        MOV     AL, DELETSCOUNT        ; LOAD NUMBER ACTUALLY DELETED
        MOV     AL, 9H                 ; HAS ANY FILES BEEN DELETED?
        JZ      FINISHED              ; NO, THEN WE ARE FINISHED
        AAR     AL, 3BH                ; ASCII ADJUST FOR MULT.
        ADD     AL, 3BH                ; MAKE AN ASCII CHAR.

        MOV     RDI PTR [DI], AL       ; STORE INTO MESSAGE
        DEC     DI                     ; MOVE MESSAGE POINTER ONE BYTE
        MOV     AL, 0H                 ; MOVE REMAINDER INTO AL
        MOV     AH, 9H                 ; SEED ANOTHER AAR

;

```

(continues)

Figure 1: DELETE.ASM file to create DELETE.COM.



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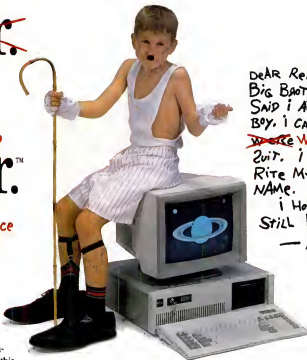
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■ USER-TO-USER

can eradicate an entire subdirectory. *DE-LETE.COM* won't.

If you really like to take risks, see the following letter.

TOTAL DESTRUCTION

Volume 6 Number 2 discussed small batch files that deleted all files in the current directory. The catch was that files beginning with \$ wouldn't be deleted, which was a drawback since many programs create temporary files beginning with dollar signs. And even small batch files take up lots of space on a hard disk.

I wrote a short (48-byte) program called *DELALL2.COM* to delete all files in the current directory at one swoop without producing any feedback whatsoever, even if there are no files to delete. (If you want some files to survive, use the *ATTR* utility to make these files read-only.)

I usually create a separate subdirectory for every project I'm working on and I

make all the vital files read only. *DELALL2* comes in handy whenever I need to clean up everything but the main files of the project.

```

H DELALL2.COM
A 100
JMP 0107
NOP
SUB CH, [002A]
MOV AH, 30
INT 21
CMP AL, 02
JL 012E
MOV DX, 0103
MOV CX, 0000
MOV AH, 4E
INT 21
CMP AX, 0002
JE 012E
MOV DX, 000E
MOV AH, 41
INT 21
MOV AH, 4F
INT 21
CMP AX, 0012
JNE 011E
JMP 012E
RCX 30
W
Q

```

Figure 3: *DELALL2.SCR* DEBUG script.

DELALL2 shouldn't be in the current directory when it is invoked because it will delete itself, so put it in a directory that is included in the path command so it can be accessed from any subdirectory. It uses the find file DOS function call, so it needs DOS 2.x or later to work.

To create *DELALL2.COM*, type the *DELALL2.SCR* DEBUG script file (Figure 3), using a pure-ASCII word processor, or the DOS COPY CON command. Be sure to hit the Enter key at the end of each line, especially the last one, and leave a blank line above RCX. Then get into DOS, put *DELALL2.SCR* and *DEBUG.COM* in the same directory, and type

```
DEBUG < DELALL2.SCR
```

Yiannis Papelis
Carbondale, Illinois

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```

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IF !11=1 GOTO GOME
FIND /V "11" NEW.DAT | FIND /V "1" > TEMP
DEL NEW.DAT
DEL TOGO
REN TEMP NEW.DAT
COPY NEW.DAT TOGO > NUL
GOTO END
:DOFF
ECHO Enter the date you want removed after
ECHO the word REMOVE
:END
  
```

Figure 5: REMOVE.BAT file for removing entries from the APP.BAT appointment programs. To remove everything on 6/12, type REMOVE 6/12. Or to remove all references to Mrs. Smith, type REMOVE Smith (observing case sensitivity and remembering this will also remove any references to any Mr. Smiths).

12/11 date at the beginning, as well as any line with a 2/1 in the memo part of a listing that starts with a totally unrelated date.

However, you can also use it to display all your appointments on all dates with Mr. Jones, by typing APP Jones (remember it's case sensitive, so it won't find JONES if you ask for Jones), or all your meetings with different people on the subject of taxes if the word taxes appears in the memo area of several different appointments with those different people. If you try searching for keywords rather than dates, remember these have to be single words—you can search for "Jones" but not "John Jones."

By the way, you can indeed have DOS remove names as well as add them. APP.BAT keeps track of things with the files NEW.BAT and TODO. The REMOVE.BAT batch file in Figure 5 uses the IV switch of the FIND filter to expunge any date you don't want from these two files. To remove everything on 6/12, just type REMOVE 6/12. Or to remove all references to Mrs. Smith, type REMOVE Smith (observing case sensitivity and remembering this will also remove any references to Mr. Smith if one exists).

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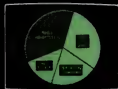
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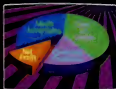
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■ CHARLES PETZOLD

PC TUTOR



Hot and cold running boot programs, more on resynchronizing keyboards, and everything you'll ever want to know about 8087 number formats.

OUT-OF-SYNC KEYBOARDS

Several readers have written to suggest other methods for getting the CapsLock and NumLock keys back in sync with the lights on KeyTronic KB 5151 keyboards (PC Tutor, Volume 6 Number 4). Some pointed out that holding down the Reset key and pressing the out-of-sync key does the trick, but they added a warning: accidentally hitting the Ctrl key while the Reset key is down has the same effect as a Ctrl-Alt-Del. Other readers noted that pressing the out-of-sync key with Ctrl depressed will also restore synchronization. Thanks for the information.

WARM BOOT FROM A PROGRAM

I have seen a couple of programs in the back pages of PC Magazine that caused an automatic reboot. However, these programs always do a cold boot rather than a warm boot. Is there any way to do a warm boot with an instruction from within a batch file?

Richard H. Martin
Little Rock, Arkansas

Sure. The major difference between a "cold boot" (which takes place when you first turn on your machine) and a "warm boot" (which occurs when you do a three-finger salute using Ctrl-Alt-Del) is that the BIOS doesn't go through its lengthy memory check when doing a warm boot.

When the BIOS keyboard handler detects a Ctrl-Alt-Del key combination, it inserts the number 1234h into the memory location 0040:0072 and then branches to address FFFF:0000. This address is 16

bytes below the very top of the processor address space. It is the same address at which the CPU begins to execute instructions following power on a CPU reset. From this address the PC's BIOS jumps to the beginning of its diagnostic routines.

You can create a small 16-byte program that performs a warm boot by entering the following lines into a DEBUG script called WARMBOOT.SCR:

```
N WARMBOOT.COM
A
MOV AX,0040
MOV DS,AX
MOV WO [0072],1234
JMP FFFF:0000
```

```
R CX
10
W
Q
```

You can then create WARMBOOT.COM by executing

```
DEBUG <WARMBOOT.SCR
```

Alternatively, rather than create WARMBOOT.SCR, you can simply run DEBUG and type the lines shown above directly into DEBUG.

For the sake of completeness, here's a COLDBOOT.SCR file that you can use to create COLDBOOT.COM:

```
N COLDBOOT.COM
A
MOV AX,0040
MOV DS,AX
MOV WO [0072],0000
```

```
JMP FFFF:0000
```

```
R CX
10
W
Q
```

USING THE 8087 IN ASSEMBLER

I'm a relative newcomer to 8086/8088 assembly language and have some questions about writing programs that use the 8087 math coprocessor chip.

First, the assembler (I'm using Microsoft MASM 4.0) inserts an FWAIT instruction in front of most 8087 instructions other than those that are specifically "no wait" instructions. I assume that this causes the 8088 to wait until the 8087 is finished with a task. However, if the first 8087 instruction my program executes is an FWAIT, sometimes my computer hangs, even when it is obvious the 8087 is not doing anything. Why is this? I could initialize the 8087 with FNINIT, but sometimes I want access to numbers that are already in the 8087 registers.

Second, MASM allows real numbers to be entered in two formats: encoded real and another that has a decimal point. When I run SYMDEB, I can dump the number in short real or long real format. But if I use a decimal point in my original number, I don't see the same number in SYMDEB. Can you tell me what format SYMDEB is using?

Third, are there any good books about 8087 programming? In particular I'm looking for routines that convert between

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readable ASCII floating-point numbers and 8087 format.

Gregory H. Henton
Reno, Nevada

A program that uses the 8087 should always initialize it with a "no wait" instruction before doing anything else. If the 8087 has a pending exception interrupt and the 8088 does not enable the interrupts, an FWAIT instruction can hang the machine.

If you want access to intermediate results that may still be stored in the 8087 registers when your program starts up, don't execute a FNINIT. Execute a FNSAVE, instead. This dumps out the contents of all 8087 registers and status words into a 94-byte area of memory and then initializes the 8087.

When using the 8087 you should use the .8087 assembler directive in your source code and assemble with the /R switch. The /R switch directs the assembler to store real numbers in 8087 (also IEEE) format.

If you are writing assembly language routines that will be linked with programs compiled using the Microsoft C, Pascal, or FORTRAN compilers, you should use MASM's /E assembler switch to allow your 8087 instructions to use the compiler's 8087 emulation library. (These "emulation" instructions are actually in the form of software interrupts that the 8087 emulation software traps either to execute the 8087 instruction or to do the emulation in software, depending on the presence of an 8087.)

If you do not use either the /R or /E switches, the assembler uses the floating-point format found in the Microsoft BASIC interpreters and QuickBASIC compiler. You don't want this format.

The 8087 can work with numbers in seven different formats. Let's take a look at them.

The first three formats are integers of 16, 32, or 64 bits where the most significant bit is a sign bit. These three integers are called "words," "short integers," and "long integers." Shown here are three assembly language instructions for storing the maximum positive values for each of these three integers:

```
WordInteger DW 32767
ShortInteger DQ 2147483647
LongInteger DQ 9223372036854775807
```

DW means "define word," DD "define double word," and DQ "define quad word." A word is 2 bytes. (Note that the use of the words "short" and "long" to define the integers is different from the use of "short" and "long" in Microsoft C. In Microsoft C, a short integer is 16 bits and a long integer is 32 bits.)

These integers are loaded into the 8087 using FILD and retrieved from the 8087 using FIST or FISTP. Different forms of these instructions apply to the three types of integers. The assembler encodes the instruction based on the memory being referenced. For instance,

FILD ShortInteger

directs the assembler to encode an FILD instruction that loads a short integer into the 8087. MASM knows to do this because ShortInteger was defined using a DD statement.

When you look at these three data types in SYMDEB you have to use the DW ("dump word") command to look at word integers and DD ("dump double word") to look at short integers. SYMDEB always displays these in hexadecimal. For DD it displays the value in a segment:offset form, as if it were an address. There is no SYMDEB instruction to look at the values of long integers, but you can look at two consecutive values dumped with DD for the long integer values.

You can also use the DD, DQ, and DT ("define ten-byte") statements for decimal real numbers. Decimal reals must either have a decimal point or use scientific notation. The three types are called short reals, long reals, and temporary reals. Here are some examples:

```
ShortReal DD 123.456
LongReal DQ 123.456789E-18
TempReal DT -1234.56789E20
```

Most of the 8087 commands (FLD, for instance, to load an 8087 register from memory) can use either short real, long real, or temporary real format. The assembler knows how the instruction should be encoded by the data type of the argument. However, if you use FLD with a label on a DD statement, but where the number is actually an integer, you'll get incorrect results because the 8087 will in-

interpret the 4 bytes as a real number rather than an integer.

Short reals use 4 bytes of storage. The numbers are accurate to six or seven significant places, with an exponent between -37 and +38. You can look at the value using SYMDEB DS ("dump short real") command.

Long reals use 8 bytes of storage and are accurate to 15 or 16 significant places, and have an exponent between -307 and +308. You can examine the values by using the SYMDEB DL (dump long real) command.

Temporary reals (also called "ten-byte reals") use 10 bytes of storage. They are accurate to 19 or 20 significant places, with an exponent between -4932 and

■ When the 8087 loads any number in any format, it converts the number into a temporary real for internal storage.

+4932. When the 8087 loads any number in any format, it converts the number into a temporary real for internal storage. (The word "temporary" refers to the 8087's internal use of this format for calculations.) You can look at the values using the SYMDEB DT command.

For the DS, DL, and DT commands, SYMDEB displays 16 significant places. For short reals, only the first seven or eight will be accurate. For long reals and temporary reals, the first 15 digits will be correct, but the last digit may not be.

"Encoded real" is not often used. This involves notating short reals, long reals, and temporary reals as a series of hexadecimal bytes. The exponent and mantissa are encoded in these bytes in the same format that you'll find when the assembler converts a decimal real into hexadecimal bytes. The hexadecimal bytes that SYMDEB displays in addition to the decimal

number when dumping reals are in an encoded real format.

Finally, there is the "packed decimal" format. This uses the DT statement and a decimal number of up to 18 digits without

a decimal point or scientific notation. The assembler packs this number by using two digits per byte. The 8087 can handle packed decimal with the instructions FBLD (to load a packed decimal) and

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PC TUTOR

FBSTP (to store a packed decimal). These instructions come in very handy for ASCII-to-8087 conversions. While there is no **SYMDEB** command to look at packed decimal numbers in **SYMDEB**, you can almost read the numbers if you just do a simple byte dump.

Reference material: While Microsoft **MASM 4.0** is very fast and **SYMDEB** is a big improvement over **DEBUG**, Microsoft's manual is a big problem. The **IBM Macro Assembler 2.0** (essentially the same assembler as the slower Microsoft **MASM 3.0**) has a far better manual (actually, two manuals). The first manual devotes a whole chapter to using the 8087. In the second manual, each 8087 instruction gets at least a page of documentation. What's even more amazing is that this documentation reads as if it were written by someone who actually had real experience in using the 8087. That's unusual.

I've also found the book 8087 Applications and Programming for the IBM PC and other PCs, by Richard Storz (Brady/Prentice-Hall, 1983), to be very helpful.

Finally, some advice: The most complex aspect of programming for the 8087 is error checking. Errors in the 8087 arise from mundane things (like division by zero) or more exotic things (loss of precision when working with very large or very small numbers). You can do error processing in one of three ways. (1) The 8087 will always calculate something reasonable if it encounters an error. This allows you to ignore errors. (2) You can check the 8087 Status Word after each calculation to see if errors have occurred. (3) You can use the 8087's "exception interrupt" to inform your program of errors. This causes the 8087 to generate an NMI (nonmaskable interrupt) to the 8088 microprocessor. This third method is by far the most complex, and I don't advise you attempt it until you've achieved a good familiarity with the workings of the 8087 and with 8088 interrupt-handling in general.

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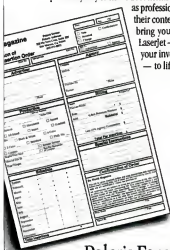
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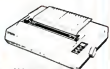
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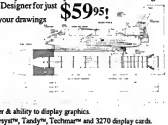
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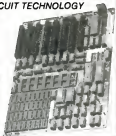
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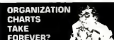
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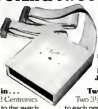
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- 2) Your primary job function is (check)**

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☐ t MIS/OP Communications Systems Programming
☐ u Engineering/R&D
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☐ e Monitors
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☐ g Modems

- ☐ h Hard Disk/Tape Back-up
☐ i Add-in Boards
☐ j LANS
☐ k Micro-Mainframe Links

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- ☐ l Communications
☐ m Accounting
☐ n Spreadsheets/Financial
☐ o Project Managers
☐ p Word Processors
☐ q Database Managers
☐ r Graphics

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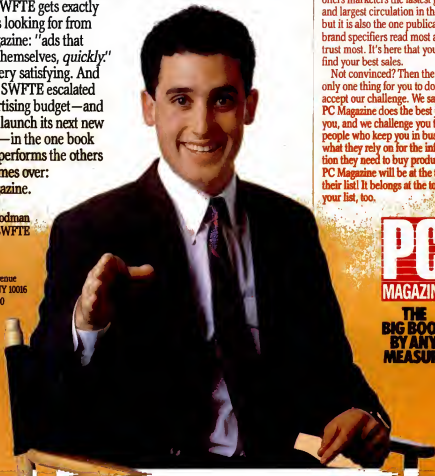
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"I Subscribe to Ten Computer Publications... I Use PC Magazine When I'm Choosing Which PC Products to Buy."

Leslie Highleyman knows exactly how crucial it is to keep current on PC technology. And when it comes to sorting through hundreds of new PC products, she's got too much at stake to take chances or try to wing it. She needs to be confident about every purchase decision she makes.

With PC Magazine behind her, it's no problem.

"I subscribe to ten computer publications...I use PC Magazine when I'm choosing which PC products to buy. It's the most reliable source of information."

With the high risks involved in the purchase decisions she has to make, Leslie Highleyman can't afford to miss a thing. So she counts on PC Magazine to help her make the correct choices.

"Even the ads in PC Magazine keep me aware of new products—and in my position, that's critical."

Leslie believes in PC Magazine.

"I refer to PC Magazine constantly. And I keep a library because our end users find it useful, too. They trust it so much, they don't bother to look elsewhere. We all really rely on what PC Magazine says."

Leslie sums it up:
"PC Magazine has clout. I've even had vendors tell me to look up something in PC Magazine."

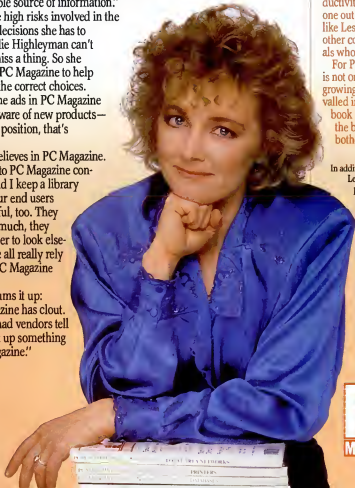
More brand specifiers like Leslie Highleyman believe in PC Magazine. For 375,000 of them, it's the Big Book. In fact, more buyers in any target market turn to PC Magazine for the product evaluations and enhanced productivity they need. Including the one out of three readers (115,000) like Leslie who are MIS/DP or other computer-titled professionals who read PC Magazine.

For PC marketers, PC Magazine is not only the largest and fastest growing MS-DOS book, it's unrivalled in influence. When one book has the clout to deliver all the buyers you seek, why bother to look anywhere else?

In addition to selecting PC products, Leslie Highleyman sets up end user policies and provides technical support and training for more than 100 end users at the Givaudan Corporation, an international manufacturer of flavors, fragrances and aromatic chemicals.

Leslie Highleyman
End User Computing Analyst
MIS Department
Givaudan Corporation
Clifton, N.J.

PC THE
MAGAZINE BIG BOOK
BY ANY
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COMING UP

IBM'S NEW GENERATION No sooner did IBM announce the Personal System/2 line of computers than we rushed the new models into PC Labs for hands-on testing. Our story includes Bill Machrone writing about the new hardware technology; Charles Petzold examining OS/2, the brand new operating system; and Paul Somerson dissecting the latest incarnation of DOS, Version 3.3. Jim Seymour rounds it off with an analysis of what it all means for both the corporate and personal user.

THE LATEST LAPTOPS Designers of laptop PCs compete with each other to provide the sharpest screen, the most complete keyboard, the longest battery life—in short, the laptop with the fewest trade-offs. *PC Magazine's* editors evaluate 11 of the newest arrivals and upgraded versions of older models.

EASY WAYS TO TRANSFER DATA Now that IBM has proclaimed the 3½-inch disk to be the new standard and now that laptop PCs are being seen more frequently, what better time to present a discussion of the various methods of transferring data from 5¼-inch floppy disks and hard disks to microfloppies.

LUXURY LASER PRINTERS Plenty of laser printers are priced up to \$3,000 more than the HP Laserjet Series II. If you buy a high-end model, what will you get for the extra dollars? Alfred Poor looks at laser printers from Quadram, NEC, AST, Genicom, and Kyocera.

1-2-3 ADD-INS The Lotus 1-2-3 Developer's Toolkit has made it possible for programmers to create some remarkable add-in programs that can give 1-2-3 true database or word processing power. Tom Badgett looks at six such programs.

ON-LINE THESAURI There's no need for more than one on-line thesaurus on your hard disk. The question is, which one is the right one? Reviews include Webster's New World On-Line Thesaurus, Whoops!, Reference Set, Word Finder, and Turbo Lightning.

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